RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

EDITOR

Howard P. Doub, M.D.
Detroit, Michigan

Volume 41

July—December 1943

Owned and Published as its Official Journal by
THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

Copyrighted, 1943, by the
Radiological Society of North America, Inc.

H.C. 2

NEXT ANNUAL MEETING, DRAKE HOTEL, CHICAGO, ILLINOIS,
NOVEMBER 29 TO DECEMBER 3, 1943

RADIOLOGY

A MONTHLY JOURNAL DEVOTED
TO CLINICAL RADIOLOGY AND
ALLIED SCIENCES

HEALTH CENTER LIBRARY

JULY · 1943

VOLUME 41 NUMBER 1

Owned and Published as its Official Journal by
THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

The Patterson Screen Company

ANNOUNCES AN IMPORTANT STEP

Will become a division of

DU PONT PHOTO PRODUCTS DEPARTMENT

WE ARE PLEASED to announce that, effective immediately, the Patterson Screen Company joins forces with E. I. du Pont de Nemours & Co., Inc. Our organization will operate as a separate and distinct unit of the Du Pont Photo Products Department and will be known as the Patterson Screen Division.

We can assure our many friends in the profession, and in our distributor organizations, that this new step means no change in Patterson standards of quality and service—no change in Patterson personnel or management. Carl V. S. Patterson, founder and president of the Patterson Screen Company, will be manager, and Frederic W. Reuter, his associate for many years, will be assistant manager, of the Division.

In the past 29 years Patterson has developed such outstanding X-ray screen improvements as the first stable fluoroscopic screen without lag, the first double intensifying screen and the first "cleanable" intensifying screen. Now the combined efforts of the Patterson and Du Pont research organizations will be devoted to continued achievements in this field.

The Patterson Screen Company

TOWANDA, PA., U.S.A.

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

Vol. 41 JULY 1943 No. 1

Correlation of Disability with Roentgen Findings Head Injuries[1]

LESLIE H. OSMOND, M.D.

St. Francis Hospital, Pittsburgh, Pa.

THE EVALUATION of structural changes of the brain and its coverings resulting in disability, following head injuries, may be greatly improved by roentgenography of the skull, encephalography, and ventriculography. Clinically, it is often difficult or impossible to evaluate the respective parts played by post-traumatic organic brain disease, post-traumatic neuroses, and unrelated abnormalities. Even when post-traumatic organic changes can be established clinically, the type and extent of the lesion often cannot be accurately determined. Roentgenographic examination of the skull, encephalography, and ventriculography may reveal structural changes which indicate the need of surgery, which make prognostic evaluation more accurate, or which establish or help to establish a basis for disability due to head injury.

FRACTURE

The simple linear fracture of the skull in itself usually means nothing as regards disability. Few cases subsequently show encephalographic evidence of cerebral damage. Of far greater significance is the fracture which crosses or courses along vascular channels, particularly the middle meningeal vascular groove, for there is apt to be a tear in the vessel with the production of an epidural hemorrhage. When the fracture line enters a mastoid, a paranasal sinus, or the nasal passage, the prognostic significance is more grave, for in these cases osteomyelitis, meningitis, meningo-encephalitis, and brain abscess are not uncommon sequelae. When the fracture line passes through channels of exit of nerves, disability due to nerve injury may follow.

The comminuted fracture, which is common in the vault and infrequent in the base, is often the tell-tale evidence of underlying cerebral damage. In depressed fractures, which involve the vault in the great majority of cases, the amount of depression of the inner plate should be measured on tangential films. If this is 5 mm. or more, there is probable pressure on the brain, which should be relieved, for thereby a decrease in the sequelae may be expected. Dyke (1) believed that the earlier such treatment is carried out, the less danger there is of permanent injury to the brain, and the less likely the patient is to have convulsions at a later date.

Compound fractures may be diagnosed by the presence of foreign material in the

[1] Presented, as part of a Symposium on Correlation of Disability with Roentgen Findings, before the Radiological Society of North America, at the Twenty-eighth Annual Meeting, Chicago, Ill., Nov. 30–Dec. 4, 1942.

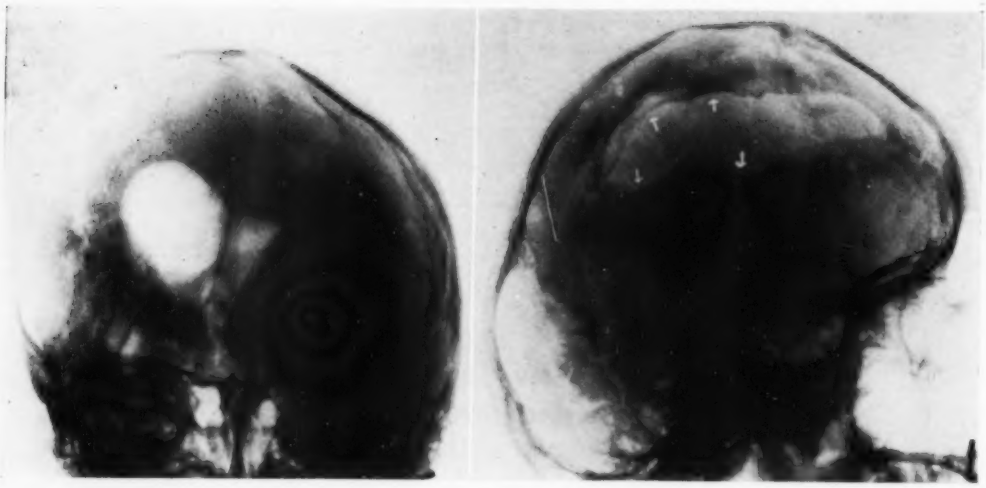

Fig. 1. White male, aged 16. History of a depressed fracture at 5 months of age, which was operated upon at 2 years of age without improvement in moderately spastic state of left arm and leg. Convulsive attacks, jacksonian in type, had been increasing in frequency throughout a three-year period.

Roentgen examination showed thinning of bony margins of the defect in the skull with scalloping or lacunae and an increased vascularity of the inner table along the margins. There was considerable asymmetry of the skull. Encephalograms showed a few dilated subarachnoid pathways below the skull defect with a unilateral ventricular dilatation and shift.

Operation revealed a dense adhesive reaction at the site of the defect with cyst-like loculated collections of fluid in it. The brain was quite firm.

Comment: Characteristic change indicating cyst-like loculated collections in the arachnoid. It is quite possible that the convulsive seizures were associated with development of this condition, as they began eleven years after removal of the depressed fragment and disappeared after the second operation.

defect or internal to it or by the presence of air within the cranial cavity, indicating a more serious prognosis.

There is one point which will bear repetition and should be stressed, namely, whether or not a prompt roentgenographic examination should be carried out in all head injuries. Patients who are in shock are not fit subjects to be moved about on a roentgen-ray table, for it is not the fracture itself which is of importance but the damage to the brain and intracranial blood vessels. According to Dyke, if the patient's vital signs are good and the clinical findings do not show that he has a depressed fracture or epidural hematoma, it is preferable to defer the roentgenographic examination until such time as he can co-operate. A delay of one or more days in the roentgen examination will not jeopardize the chance of recovery and may prove of great value in convalescence. It is hard for a young man to refuse roentgenographic examination on admission, when a more experienced and higher ranking staff man insists upon it. The writer failed to do his duty on two such occasions and saw the patients go on to death within several hours after the unwarranted strain of a roentgenographic procedure. He is determined not to allow this to happen again. If evidence is needed for medico-legal reasons, the examination may be carried out after death if the patient fails to recover.

From the roentgenographic appearance of old fractures, one may detect evidence of sufficient pathology of the brain or its coverings to explain varying degrees of disability. The old residual linear type of fracture without calcification beneath the inner table is of little importance in establishing disability, but in the comminuted and depressed types either of two changes may occur which are of significance. The first is thickening of the bone not only immediately adjacent to the fracture but also in that part considerably removed

from it. Dyke states that even other homolateral bones may become increased in thickness. Occasionally, the air sinuses on the side of the fracture are hypertrophied. In these cases generalized atrophy or more localized degeneration of the brain may be expected. The second change which is often seen at the site of old fractures is a widening of the defect, with associated thinning of the bone at the margins. There may be scalloping or lacunae and an increased vascularity of the inner table of the skull along the fracture margins. When this is seen, one may predict a dense fibrotic leptomeningeal reaction with loculated cyst-like collections of fluid at the site of the defect. In this condition, the erosion of bone results from the pressure of the cystic collections of fluid on the skull with each pulsation of the brain. As a rule, there are in such patients varying degrees of atrophy of the brain and asymmetry of the skull (Fig. 1).

OSTEOMYELITIS

Head trauma may result in the development of osteomyelitis, which may be either of two types: the first manifesting itself at the site of trauma without the scalp having been lacerated (Pott's puffy tumor) and the second being the result of direct invasion of bacteria through an open wound. Disability is due to the effects of inflammation and the absorption of its products unless the infection spreads to the meninges or brain.

EPIDURAL (EXTRADURAL) HEMATOMA

A linear fracture line passing from the parietal region downward and forward toward the middle fossa and crossing or coursing along the bony groove of the middle meningeal artery or one of its branches is the usual roentgen finding in epidural hematoma. Stressing this position in roentgen reports is important. Rarely does such a hematoma result from a tear of a vascular channel elsewhere which is sufficient to produce real trouble. The wider the line of fracture and the deeper the vessel channel, the more likely the development of an epidural hematoma.

SUBDURAL HEMATOMA

The acute subdural hematoma is usually associated with a fracture of the skull, while in the usual type of chronic subdural hematoma a fracture is rarely found.

The evidence of chronic subdural hematoma in routine roentgenograms, encephalograms, and ventriculograms, is that of a space-occupying lesion. The great majority are in the lateral aspect of the fronto-parietal region; more rarely they are seen over the occipital poles or cerebellar hemispheres. Occasionally in encephalography, gas may collect between the inner false membrane of the hematoma and the pia arachnoid and collapsed brain, or between the outer membrane of the hematoma and the skull. Dyke (2) states that the former occurrence is pathognomonic of subdural hematoma.

In addition to (1) the usual type of chronic subdural hematoma, one may further divide this condition into (2) subdural hematoma in the newborn or in infancy, (3) chronic calcified or ossified subdural hematoma, and (4) juvenile relapsing chronic subdural hematoma. Very definite roentgenographic evidences of pathology may be recognized in these disabling conditions (for excellent descriptions see Dyke and Davidoff, 3).

INTRACEREBRAL HEMORRHAGE

Rarely is there opportunity to study intracerebral hemorrhage roentgenographically. It is apparent from the literature that there is seldom a fracture of the skull. There may be partial calcification of the hematoma. Ventriculography or encephalography gives evidence of a space-occupying lesion within the intracranial cavity.

CEREBRAL HEMIATROPHY OR HEMIHYPOPLASIA WITH HOMOLATERAL HYPERTROPHY OF SKULL AND SINUSES

In cerebral hemiatrophy or hemihypoplasia with homolateral hypertrophy of

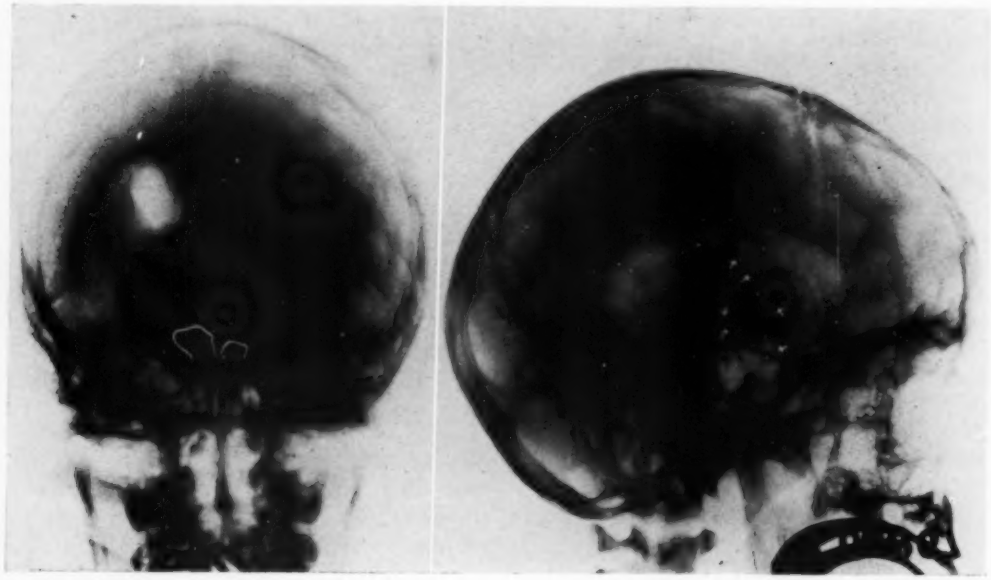

Fig. 2. White female, aged 4. Head injury at 1 year, followed by comatose state. Some degree of paralysis persisted on entire left side of body.

Encephalograms: Note on the right side of the head thickening of the calvarium, with loss of convolutional impressions, smaller size of skull, greater development of frontal sinus, higher level of superior orbital margin and petrous ridge, uniform dilatation of lateral ventricle with shift, marked obliteration of subarachnoid pathways (obliterative arachnoiditis) except for a few dilated ones inferiorly, as shown by arrows (air injected with patient lying on left side accounting for lack of filling on the left), indicating cerebral hemiatrophy with homolateral hypertrophy of skull and sinuses.

Operation showed fibrous adhesive reaction of leptomeninges. Needling located a hard mass 2 cm. below the motor surface area, probably intracerebral scar.

Prognosis: Poor, though marked improvement of facial palsy occurred.

the skull and sinuses there is usually a history of severe head trauma early in childhood. Roentgenographic evidence of unilateral thickening of the calvarium with diminution or complete loss of convolutional markings and enlargement of the frontal and ethmoidal sinuses and air cells of the petrous pyramid and an associated reduction in size of the calvarium portends a homolateral dilatation of the lateral ventricle and possibly of the third ventricle, with displacement toward the affected side and dilated or obliterated subarachnoid pathways, all of which may be clearly demonstrated by encephalograms (Fig. 2). Dyke, Davidoff, and Masson (4) have shown encephalographically that disability in childhood cannot be regarded as stationary. In the writer's experience there has always been a severe degree of disability when the roentgen findings of this condition were prominent.

PNEUMO-ENCEPHALOGRAPHY IN POST-TRAUMATIC BRAIN CONDITIONS: PORENCEPHALY, CEREBRAL ATROPHY, ARACHNOIDITIS, AND SCAR

The pathologic cause of the profound changes seen on encephalography following trauma, particularly in cerebral atrophy, are in dispute. There are probably several factors, one or more being operative in each case. Winkelman and Fay (5) have expressed the belief that traumatic cerebral atrophy is a pressure atrophy due to a disturbance in the cerebrospinal fluid-eliminating mechanism (subarachnoid villi and pacchionian bodies), permitting an increase in the amount of supracortical fluid, with pressure. As a result of Bagley's observation (6) of arachnoiditis produced from blood introduced into the subarach-

Fig. 3. White female, aged 51. History of a head injury followed by an unspecified period of unconsciousness 9 years earlier. No history of a serious illness was obtainable. There had been noticeable memory failure one year ago with gradual loss of ability to perform household duties. Physical examination was essentially negative.
Encephalograms showed symmetrical bilateral ventricular enlargement with a marked communicating area of localized dilatation of subarachnoid pathways with considerable local loss of brain substance over the left parietal area, representing an external porencephaly associated with bilateral cerebral atrophy. The non-visualized areas may represent undrained channels, adhesive arachnoiditis, or a combination of both.
Comment: Encephalograms establish a very poor prognosis and strongly suggest head injury as the etiological factor.

noid spaces, Fay expressed the belief that cerebral trauma producing subarachnoid hemorrhage injures the pacchionian bodies, producing obstruction to outflow of cerebrospinal fluid, with secondary pressure atrophy of the cortex. When necropsy studies have been possible in cases of death resulting from some cause other than concussion, acute cerebral injury in the form of multiple punctate intracerebral hemorrhages has been shown. Osnato and Giliberti (7), from a review of the literature and their own pathologic studies, found diffuse perivascular hemorrhagic infiltration similar to the perivascular pathology of acute encephalitis. They concluded that cases of concussion do show evidence of structural cerebral injury and that there is a strong likelihood of the development of secondary degenerative changes. They believe, therefore, that post-concussion neuroses should properly be called traumatic encephalitis. The concept of traumatic encephalitis seems to explain some cases better than Fay's concept of pressure atrophy from obstruction. As stated before, however, the combination of factors (cerebral edema, subarachnoid hemorrhage, and minute intracerebral hemorrhages) probably produces the majority of cases of cerebral atrophy. Obliterative arachnoiditis due to trauma is best explained by previous subarachnoid hemorrhage.

Damage to the brain following head injuries is manifested encephalographically by porencephaly, cerebral atrophy, arachnoiditis, and scar formation. The presence or absence of any or all of these manifestations is of great help in evaluating the respective parts played by post-traumatic organic brain disease and post-traumatic neurosis, but it is important to consider whether deformity must necessarily occasion abnormal function and whether the changes are due to trauma or some other cause.

Porencephaly, either external (Dyke, 1) or internal, is the most characteristic change in brain trauma and occurs chiefly in the cerebrum, though it apparently may occur in the cerebellum. One or more

porencephalic cavities may originate at any point along a ventricle or at the periphery of the hemispheres (Fig. 3). They may vary greatly in size. With internal porencephaly, there is generally a homolateral cerebral atrophy with ipsolateral ventricular dilatation. Occasionally there is a lesser amount of similar change on the opposite side.

Cerebral atrophy is evidenced in the encephalogram by a variety of changes. There is usually a unilateral or bilateral dilatation of cerebral subarachnoid pathways associated with unilateral or bilateral ventricular enlargement. If the atrophy is peripheral (cortical atrophy), there may be no ventricular enlargement (Fig. 4). There may be an obliterative arachnoiditis associated (Fig. 2). In generalized bilateral cerebral atrophy, there is also enlargement of the third and occasionally the fourth ventricles, together

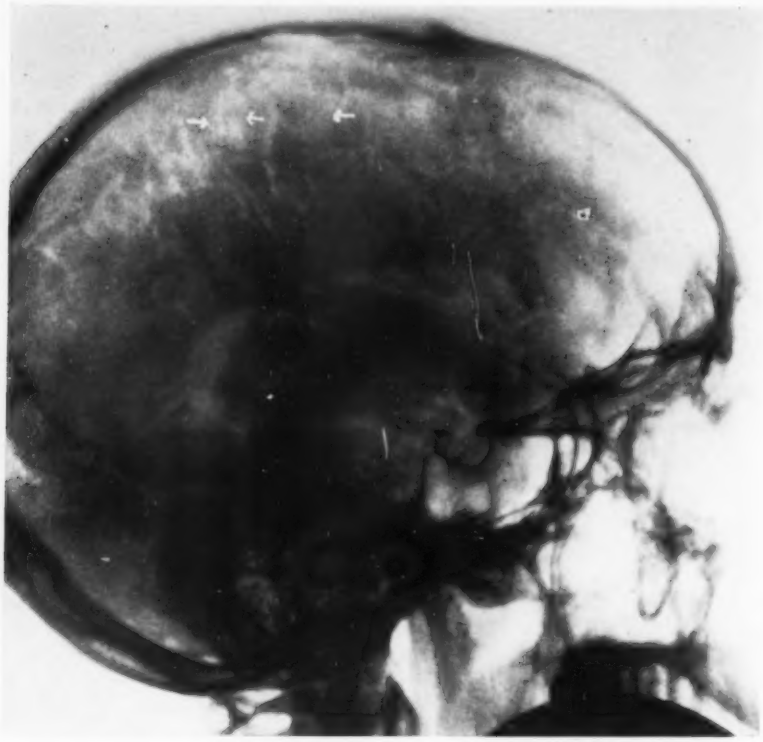

Fig. 4. White male, aged 29. Perfectly well until five weeks before examination, when he began to experience recurrent peculiar sensations, feeling as though there were a pull on the right arm; he was dazed during spells. There was a history of injury to the left mid-parietal area one year before, when the patient was temporarily dazed but continued work. Physical examination negative. *Clinical impression:* Post-traumatic neurosis.

Encephalograms showed dilated subarachnoid spaces covering an area about 3 cm. in diameter (arrows) over the left mid-parietal area (determined stereoscopically) without dilatation of ventricles sufficient to indicate localized peripheral cerebral atrophy (cortical atrophy), apparently post-traumatic.

Operation: Subarachnoid spaces found to be quite deep over an atrophic, firm, yellow-colored cortex in an area about 3 cm. in diameter involving the precentral and postcentral gyri.

Comment: Penfield (10) believes that this type of brain damage probably follows subpial hemorrhage. Encephalograms with operative verification establish an organic basis for symptoms.

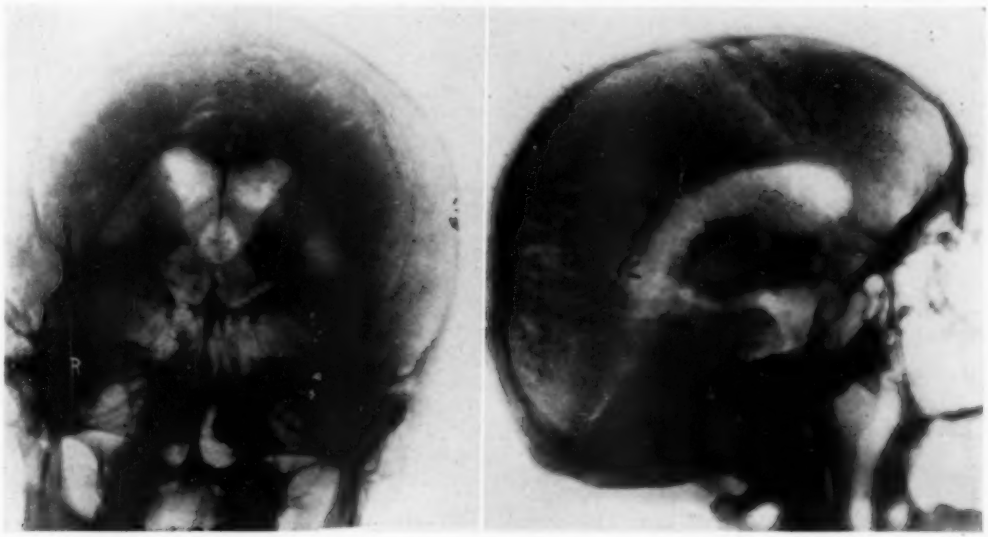

Fig. 5. White male, aged 22. History of generalized convulsive seizures for five years, accompanied by loss of consciousness and becoming more severe and more frequent. These episodes began about two months after a severe injury to the back of the head. Physical examination revealed some weakness of the left arm. Examination of the spinal fluid was negative.

Encephalograms showed moderate symmetrical dilatation of entire ventricular system and basal cisternae; obliteration of the subarachnoid pathways over all of the right frontal and most of the left frontal lobes, with a few dilated channels in the anterior region of the sylvian fissure. Encephalograms made elsewhere, soon after convulsive attacks started, revealed no abnormal variation. Repeated encephalograms over a three-year period demonstrated progressive ventricular enlargement. Findings indicated a chronic arachnoiditis, either obliterative or other abnormal structural change resulting in repeated failure of drainage, and generalized cerebral atrophy.

Operation: Right frontal exploratory craniotomy showed an excessive amount of turbid fluid in dilated subarachnoid channels, thickening of the pia, and deepening of the convolutions.

Comment: The encephalographic findings might well be due to an infectious type of arachnoiditis, but the history is of definite help in evaluation. Convulsive seizures had ceased for one year following the craniotomy and they stopped for six months following the first spinal air injection. This case demonstrates that the lack of positive findings does not rule out the possibility of abnormal changes.

with the cerebral subarachnoid pathways and the lateral ventricles. These changes are less characteristic of brain trauma than is porencephaly. They are found frequently and one might expect them to be indicative of a single disease. On the contrary, they have been observed in idiopathic epilepsy, in early dementia paralytica, in multiple sclerosis, in parkinsonism, in cerebral arteriosclerosis, and in patients who showed no demonstrable neurologic signs of any kind. Therefore, such changes should be ascribed to trauma only if the history definitely points to injury as the etiological factor.

Arachnoiditis is disclosed by an absence of cortical markings in the encephalogram, but one must detect some of the other changes already described before he can be reasonably certain that such absence of cortical markings is due to adhesive or obliterative arachnoiditis or chronic arachnoiditis with dilated, fluid-filled channels which failed to drain (Fig. 5). Failure of localized or more generalized visualization unilaterally or bilaterally may occur without any demonstrable cause. If there is non-visualization of pathways with dilated channels inferiorly, one can be reasonably certain that there is an obliterative arachnoiditis in the non-visualized area above (Figs. 2 and 6).

The regional dilatation of a ventricle which may also present the appearance of traction or distortion toward a focal region is characteristic of a meningocerebral cicatrix (Fig. 7), a focal cerebral cicatrix, or a focal brain atrophy (Penfield, 8).

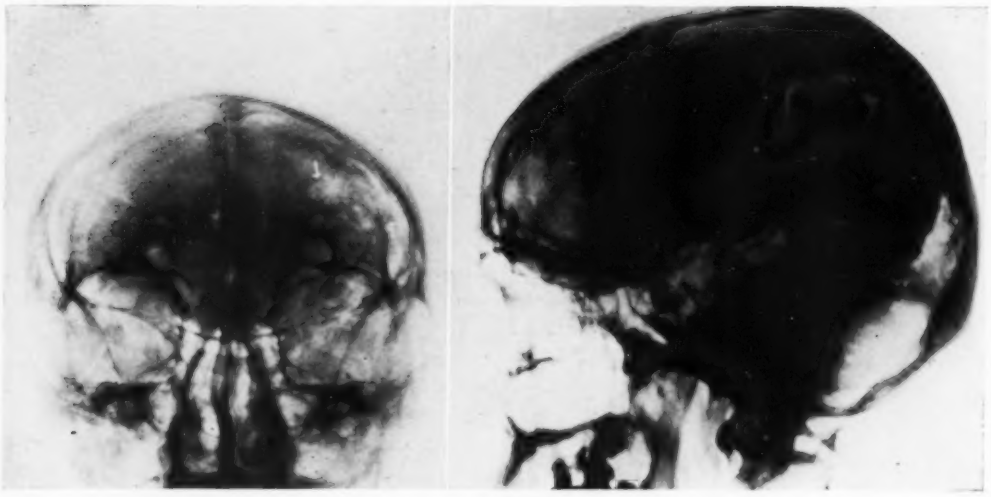

Fig. 6. White male, aged 33. History of injury to right parietal area one year earlier, followed by a 45-minute period of unconsciousness. The patient was confined to hospital for thirty-four days without evidence of skull fracture. He complained of headache, predominantly on right side of head, and dizziness almost daily since the accident; had noticed numbness and tingling sensation in right hand and fingers and both feet for one month; complained of staggering in daylight. Physical examination negative. *Clinical impression:* Possible post-traumatic brain damage, but probable post-traumatic neurosis.

Encephalograms showed localized dilatation of subarachnoid pathways in left mid-parietal area, with non-visualization of pathways above, indicating some localized peripheral cerebral atrophy with probable adhesive reaction above.

Comment: Findings sufficient to help in establishing an organic basis for patient's symptoms. Ventricular visualization also would have helped more in evaluating the severity of the damage to the brain.

Evans and McEachem (9) have produced evidence to show that ventricular shift may occur without local pull of scar. The ventricular dilatation and shift are probably due to the enlargement of the ventricle to take up the space formerly occupied by the products of acute brain trauma which have eventually been replaced by localized cerebral cicatrix and/or more generalized gliosis (Fig. 2). A meningocerebral cicatrix may actually be seen if air surrounds it in the subdural space (Fig. 7).

In the writer's experience, porencephaly, unilateral cerebral atrophy, and cerebral scar have been associated with a definite history of previous head injury with a single exception—one case of bilateral internal porencephaly. In this instance, the process followed a severe acute illness in infancy, but from the history trauma still could not be definitely excluded. It is recognized that other unrelated processes may occasionally cause such abnormalities. Symmetrical generalized bilateral cerebral atrophy and chronic arachnoiditis, either with obliterated or undrained, dilated, fluid-filled pathways, must be associated with a definite history of head trauma before being ascribed to post-traumatic changes.

Symptomatology associated with porencephaly, cerebral atrophy, arachnoiditis, and scar varies greatly and is not always in proportion to the extent of the structural changes which can be evaluated. Dizziness, personality changes, general or focal weakness, spastic paralysis, faulty vision, and especially headache and convulsive seizures, either generalized or jacksonian in type, are prominent symptoms. Grant (11) has observed a very high incidence of cerebral atrophy as a principal finding in post-traumatic headache, but no greater incidence in post-traumatic epilepsy than in epilepsy unrelated to trauma. Ventricular asymmetry, which includes scar formation, was nine times as frequent in post-traumatic epilepsy as in non-traumatic epilepsy and three times as frequent

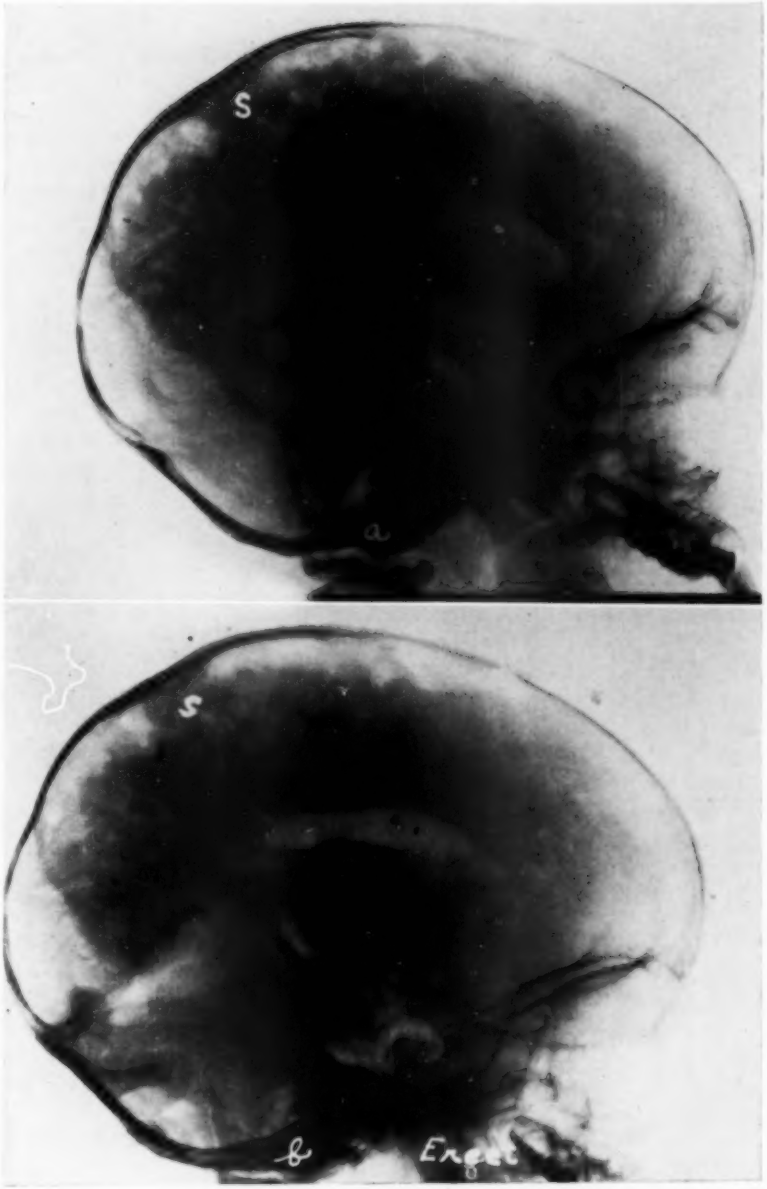

Fig. 7. White female, aged 1 year. There was no history of injury, but the child was not developing properly; fontanels closed since six months of age; no convulsions. Physical examination revealed a backward child; significance uncertain.

Routine roentgenograms showed minimal depression in left parietal area with calcification beneath the inner table which, with the history, indicated marked post-traumatic brain damage. *Encephalograms* showed a meningo-cerebral scar outlined by subdural air (S), regional dilatation of posterior superior portion of the left lateral ventricle, bilateral lateral ventricular and subarachnoid pathway dilatation including several cisternae.

Comment: Roentgen examination satisfactorily disclosed evidence of severe post-traumatic brain damage with extremely poor prognosis without operation and without the benefit of history of a head injury.

as in post-traumatic headache. Arachnoiditis as a principal finding was definitely more frequent in post-traumatic epilepsy than in epilepsy unrelated to trauma and much more frequent than in post-traumatic headache. There is a rather high incidence of convulsive seizures with porencephaly in the frontal lobe.

Many claims have been made for the therapeutic value of air injected into subarachnoid pathways. In a small percentage of cases, results may be unexpectedly favorable in epilepsy from this procedure alone, but they are not lasting. The results are much better for post-traumatic headache, especially if there are no demonstrable structural changes evident.

SUMMARY

Disability following head injuries varies greatly and corresponds well with the character and extent of the structural changes as revealed by roentgenography of the skull and encephalography (ventriculography for expanding lesions within the cranium, which produce increased intracranial pressure). Cases without positive findings on physical examination may be classed as post-traumatic neuroses clinically. Encephalography may reveal this classification to be erroneous by depicting a definite organic basis for the symptomatology. A lack of structural changes several months after an injury to the head cannot be regarded as conclusive evidence of the non-existence of damage to the brain or the meninges. When disabling states following head injuries are established by the history and physical examination as due to an organic abnormality, roentgenography of the skull, encephalography and occasionally ventriculography may aid greatly in evaluating the type and extent of structural changes and may indicate the need of surgery, may make prognosis more accurate, or may establish or help to establish a basis for disability.

St. Francis Hospital
Pittsburgh, Penna.

REFERENCES

1. DYKE, C. G.: Injuries of Skull, Brain and Spinal Cord. Baltimore, Williams & Wilkins Co., 1940, p. 407.

2. DYKE, C. G.: A Pathognomonic Encephalographic Sign of Subdural Hematoma. Bull. Neurol. Inst. New York **5:** 135–140, August 1936.

3. DYKE, C. G., AND DAVIDOFF, L. M.: Chronic Subdural Hematoma. Bull. Neurol. Inst. New York **7:** 112–147, September 1938.

4. DYKE, C. G., DAVIDOFF, L. M., AND MASSON, C. B.: Cerebral Hemiatrophy with Homolateral Hypertrophy of Skull and Sinuses. Surg., Gynec. & Obst. **57:** 588–600, November 1933.

5. WINKELMAN, N. W., AND FAY, T.: The Pacchionian System; Histologic and Pathologic Changes with Particular Reference to the Idiopathic and Symptomatic Convulsive States. Arch. Neurol. & Psychiat. **23:** 44–64, January 1930.

6. BAGLEY, C., JR.: Functional and Organic Alterations Following the Introduction of Blood into the Cerebrospinal Fluid. Proc. A. Res. Nerv. & Ment. Dis. **8:** 217, 1927.

7. OSNATO, M., AND GILIBERTI, V.: Postconcussion Neurosis; Traumatic Encephalitis; Conception of Postconcussion Phenomena. Arch. Neurol. & Psychiat. **18:** 181–214, August 1927.

8. PENFIELD, W., AND NORCROSS, N. C.: Subdural Traction and Post-Traumatic Headache: Study of Pathology and Therapeusis. Arch. Neurol. & Psychiat. **36:** 75–95, July 1936.

9. EVANS, J. P., AND MCEACHEM, D.: Circulatory Changes in Cerebral Vascular Occlusion and in Cerebral Cicatrization. The Circulation of the Brain and Spinal Cord. Baltimore, Williams & Wilkins Co., 1938.

10. PENFIELD, W.: Epilepsy and Surgical Therapy. Arch. Neurol. & Psychiat. **36:** 449–484, September 1936.

11. GRANT, F. C.: Ventriculography and Encephalography; Their Value in the Localization and Treatment of Intracranial Lesions. Arch. Neurol. & Psychiat. **27:** 1310–1341, June 1932.

Correlation of Disability with Roentgen and Clinical Findings in Silicosis: Part I[1]

PAUL BOVARD, M.D.

Tarentum, Penna.

DISABILITY DUE to pathologic conditions in the thorax may originate from trauma to the bony thoracic cage or its contents, from diseases which may affect other parts of the body, or from diseases peculiar to the lungs. As it is obviously impossible to discuss the differential diagnosis and treatment of each of these, the present discussion will be limited to the consideration of pulmonary pathology as it is related to the health of workers subject to industrial dust hazards.

The pre-employment record of such workers should contain a family history, including references to any tuberculous contact. The clinical history should contain information regarding previous illnesses referable to the respiratory system, and the physical examination should cover conventional methods of examination, plus such special lung function tests as are employed by McCann of Rochester, N. Y., Crombie and Blaisdell of the Porcupine Clinic for Silicosis Research, and Hannon of Washington, Penna. These tests are fairly simple and offer a means of accurate measurement of lung ventilation which can be checked at intervals after exposure to determine whether there has been a decrease in pulmonary efficiency.

Probably the most important part of the pre-employment record is the occupational history, which should be taken by an experienced person and should include mention of all jobs since the applicant left school to go to work. This record may be valuable later for medical or legal reference.

Pre-employment chest films may be stereoscopic or plain conventional 14 × 17 in., or stereoscopic 4 × 10 in., or 35 mm., such as are being used in Army induction examinations, but the quality should be excellent and constant, to assure justice to the applicant, the employer, and the examiner.

It is incumbent upon the consultant in this field to become familiar with the type of work for which the men are hired and the dust hazard connected with the work, just as it is necessary to study the basic sciences before being admitted to medical school. Failure to familiarize himself with the dust hazard of a job may cause an unbiased expert to make a diagnosis of silicosis with total disability in a man who has never been exposed to silica, since other lesions present a very similar appearance.

Criteria for rejection, on the basis of pre-employment films, of applicants for jobs entailing a silica hazard are: (1) active pulmonary tuberculosis; (2) extensive stable primary tuberculosis in those under thirty years of age; (3) primary tuberculosis of questionable stability; (4) inactive adult type tuberculosis; (5) silicosis which is definitely suspected from the film alone, especially when there is history of exposure to silica; (6) emphysema; (7) any other pulmonary pathology of known or unknown etiology which may render the applicant an unfavorable risk from the standpoint of his own health or which might later be confused with silicosis by the examiner or by some other physician and terminate in a legal controversy.

After a man is found to be acceptable and employed, a careful record of absenteeism and its causes should be kept, with special reference to pulmonary illness. Routine check-up clinical examinations and roentgen films of the chest should be made, and

[1] Presented, as part of a Symposium on Correlation of Disabilities with Roentgen Findings, before the Radiological Society of North America, at the Twenty-eighth Annual Meeting, Chicago, Ill., Nov. 30–Dec. 4, 1942.

the latter should be compared with previous films. If disability is suspected, a special clinical examination should be made which should include the lung function tests mentioned previously.

Roentgen evidence of disability is often unreliable and inaccurate. Experience has proved that uncomplicated silicosis may be associated with moderate fibrotic changes and a considerable degree of disability, whereas in other cases massive lesions may produce only a slight decrease in capacity for work.

The studies by Irwin and his co-workers at Banting Institute indicate that a considerable part of the dyspnea in silicotics is due to fibrosis of the alveolus itself and not to the nodular fibrosis. This may explain the unreliability of roentgen estimation of disability. Irwin dusted animals with silica and found thickening of the alveolar walls. Later, some of the same group of animals were treated with inhalations of aluminum powder, and subsequent sections of the treated lungs showed no thickening of the alveolar walls. This type of improvement in alveolar elasticity is probably responsible for the relief of symptoms in the treated silicotic patients whom I have observed.

When roentgen evidence of superimposed infection is present, however, disability should be anticipated; if there is roentgen evidence of a superimposed active pulmonary tuberculosis, the roentgenologist may state with confidence that disability is total and permanent. In the absence of cavitation, the diagnosis of tuberculosis in advanced silicosis is very difficult and should be made only when there is laboratory confirmation. The diagnosis of superimposed infection which is not characteristic of tuberculosis may also be extremely difficult on the basis of films made during a single examination, but when serial films which have been made at regular intervals over a period of years are studied, there should be little difficulty in discovering the roentgen evidence of impending disability.

Massive lesions in the upper mid-zones have, in my experience, been found to cause apparent disability in some workers, while others experience little discomfort from lesions of major proportions. This apparent paradox may be explained by the fact that the disability experienced in some cases is due to the thickening and fibrosis of the alveolar walls, with little nodular evidence of the disease, or by the prodigality of nature in supplying an overabundance of pulmonary tissue.

Most states where industrial dust hazards prevail have some sort of occupational disease legislation for the mutual benefit of employers and employees. In some this is more satisfactory than in others, but as a whole these regulations have served to decrease the very real cause of the hysteria which existed prior to their enactment, when suits in civil court were brought for large sums of money, though the plaintiff's disability was seldom related to his occupation. There still appears to exist a need for closer co-operation between our legislative bodies and the medical profession in arriving at a means of determining accurately the degree of disability in silicotics.

Conclusions: Disability in industrial lung disease cannot be accurately estimated by roentgen examination alone.

306 Corbet St.
Tarentum, Penna.

Correlation of Disability with Roentgen and Clinical Findings in Silicosis: Part II[1]

J. W. G. HANNON, M.D.

Washington, Penna.

THE TOXICITY of silica particles is inversely proportional to their size. The natural protective mechanism of the respiratory passages filters out a large percentage of the dust particles that are inhaled and very few are retained in the alveolar spaces of the lungs.

The particles which are retained set up an irritation in the alveolar walls. Wandering monocytes or phagocytic cells appear from the reticulum of the cellular wall, invade the lumen of the air sac, and engulf the particles. These cells may then arrange themselves in layers upon the lining membrane of the air sac (Fig. 1), thus thickening the walls and decreasing the elasticity of the air sac, which interferes with the normal gaseous exchange.

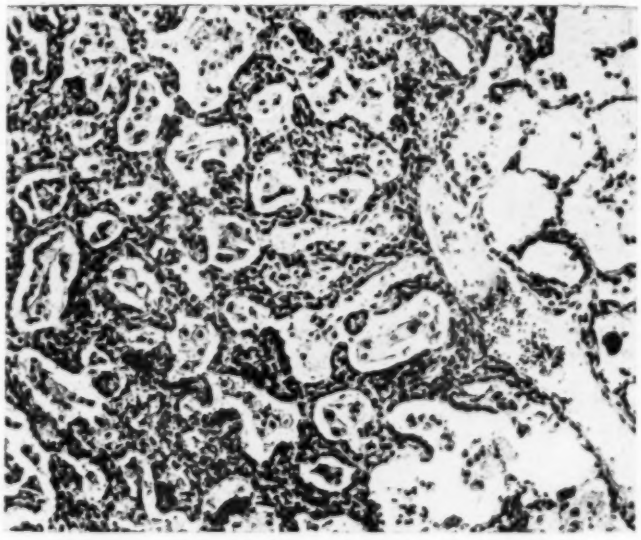

Fig. 1. Section of a lung showing thickened alveolar walls.

As long as the terminal bronchiole is patent, the cells gradually migrate toward the lumen and are removed with the normal bronchial drainage, which is coughed up. If a break occurs in the lining of the air sac, or in the mucous membrane of the bronchiole (Fig. 2), these dust laden monocytes invade the lymphatic channels and eventually infiltrate the lymph nodes. Here they produce a reaction which is characteristic of their chemical properties. If obstruction occurs along the lymphatic channels, the cells congregate at this point and the same reaction occurs. In the case of inert dusts a typical foreign body reaction asserts itself at the point of obstruction.

If the monocytes engulf silica particles of a toxic size, a far different change takes place. The silica, by reason of its solubility, reacts with the cell fluids to form *silicic acid*, which causes characteristic

[1] Presented, as part of a Symposium on Correlation of Disabilities with Roentgen Findings, before the Radiological Society of North America, at the Twenty-eighth Annual Meeting, Chicago, Ill., Nov. 30–Dec. 4, 1942.

Fig. 2. A. Denuded epithelium of a terminal bronchiole. B. Infiltration of monocytes.

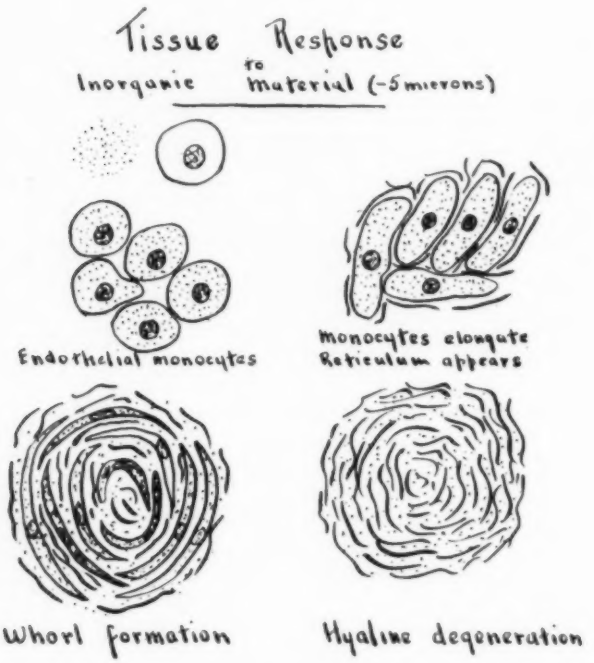

Fig. 3. Diagram showing the tissue response to silica (after D. A. Irwin).

changes in the cells (Fig. 3). *First*, dust-laden cells in the lymphatic channels elongate and reticulum appears in the intercellular spaces. *Second*, the cells elongate further and assume histological characteristics of fibroblasts and tend to arrange themselves in concentric nodules. *Third*, the cells lose their nuclei, and the nodule becomes fibrous and undergoes hyaline degeneration. As the disease progresses the lymphatic drainage becomes blocked, and with obstruction in the bronchioles, these proliferative changes may take place in the air sac itself. The transition of the monocyte to a fibrocyte is characteristic of the cellular response to silica (Fig. 4).

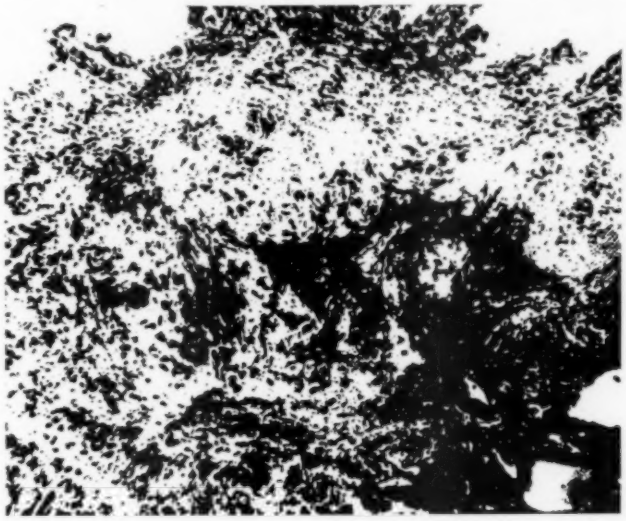

Fig. 4. Silicotic nodule with thickened alveolar walls around periphery. The fuzzy appearance on the x-ray film may be mistaken for infection.

Pneumoconiosis presents a medicolegal problem of major importance. Many studies have been made of the etiology, pathogenesis, and x-ray diagnosis, but until recently very little has been done on the practical physiologic aspect, outside of a few of the more scientific laboratories. Measurement of disability is becoming more important, as there is a growing tendency for workmen's compensation boards to adjust awards to degree of disability.

The degree of dysfunction of the lungs in pulmonary fibrosis is not proportional to the amount of anatomic change revealed by the x-ray film. Inhalation of toxic dusts, such as silicon dioxide, frequently decreases pulmonary function before the shadows of the silicotic nodule become visible on the roentgenogram.

Disability in silicotics varies greatly in degree, although the x-ray films in two or more cases may indicate that the abnormal changes are apparently equal. This is especially true in the moderate and far advanced cases.

The work of Dr. Dudley Irwin of Toronto indicates that disability in silicotics is not primarily due to nodular fibrosis, but is caused by the thickening of the alveolar walls and associated emphysematous changes with decreased elasticity of the lungs and interference with normal gaseous exchange. These changes are present before nodular fibrosis is visible on the x-ray film. Later edema of the air sacs and terminal bronchioles and engorgement of the capillaries surrounding these structures are contributing factors in causing disability. We must estimate disability, therefore, in terms of altered function of the lungs rather than by the degree of nodulation visible on the x-ray film.

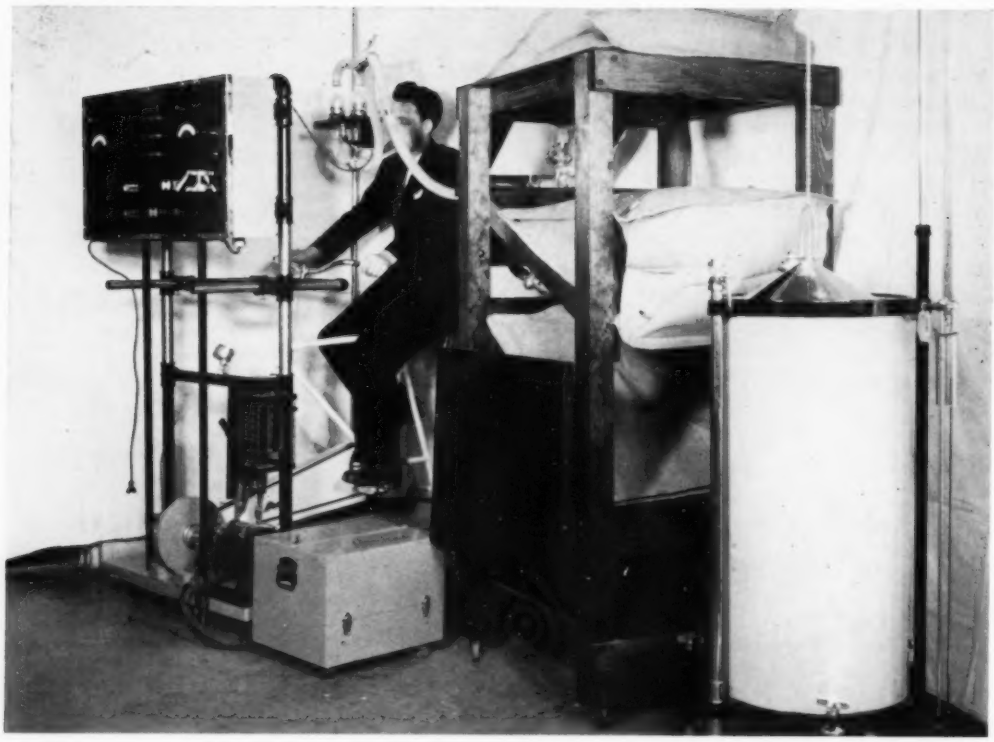

Fig. 5. Bicycle ergometer used by Doctors D. W. Crombie and J. L. Blaisdell at McIntyre Porcupine Clinic for Silicosis Research.

RESPIRATORY FUNCTION TESTS

Respiratory function tests are of two main types. *First*, the patient is examined at rest. The total respiratory capacity of the lungs is measured and broken down into its components:

(1) Vital capacity
(2) Complemental air
(3) Tidal air
(4) Reserve air
(5) Mid-capacity or functional residual air
(6) Residual air

Second, the patient is examined during exercise. We believe exercise tests are more practical and less complicated than measuring the components of the total respiratory capacity. In giving an opinion of a man's disability we estimate, *in percentage*, his ability to work. It would therefore seem plausible that we test him at work or during exercise.

The essential part of these tests is observing and recording the respiratory rate and the amount of air breathed *before*, *during*, and *after exercise*. For this purpose a bicycle ergometer is used (Fig. 5). This unit has a braking system consisting of a dynamo or a prony brake, against which the subject pedals as though he were riding a bicycle. By means of various settings any predetermined amount of work can be given with these units. With certain settings and with the subject pedaling *20 miles per hour* we know that he is doing *600 kilogram meters work* per minute, and this can be duplicated exactly from time to time. This exercise compares with pedaling a bicycle up a steep grade at 20 miles per hour. Before the ergometer test, the man is told to exhale as fast as he can, with his maximum effort, into a large

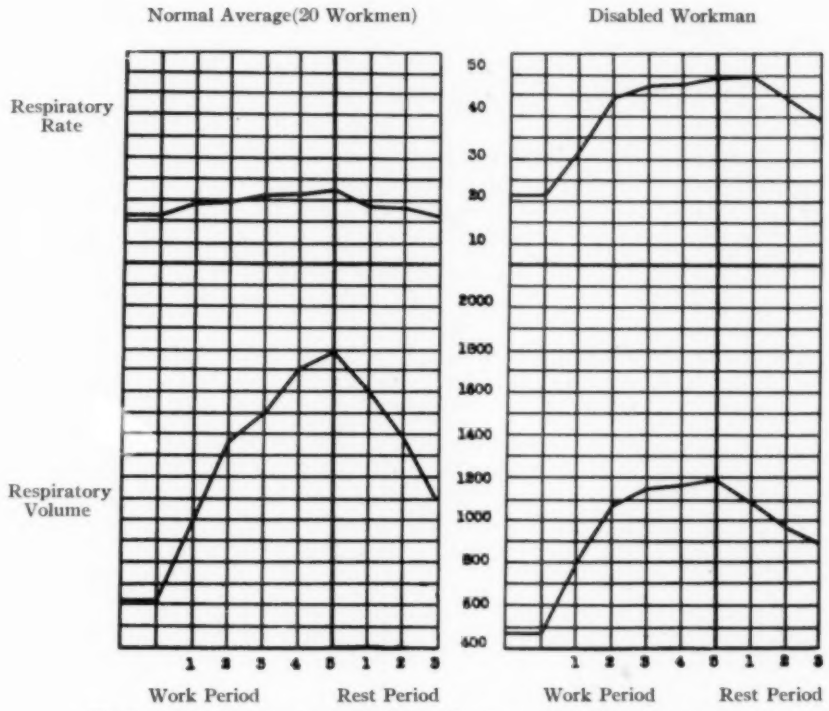

Fig. 6. Bicycle ergometer graph illustrating normal and disability curves.

Douglas bag for one minute. His respirations are counted and the amount of air measured. This is called the *maximum minute ventilation* and averages about *118 liters per minute* in the normal subject.

The man is then seated on the bicycle ergometer for fifteen minutes, during which period he is resting. The last seven minutes he breathes into a Douglas bag or meter while his respirations are counted and the air measured. This is called the *normal minute ventilation*. The amount of air is divided by the number of respirations and this figure is the *tidal volume*. The man is then exercised on the bicycle for five minutes at 600 kilogram meters work, then rested for three minutes. The respirations during these periods are counted, and the exhaled air is collected and measured each minute during exercise and rest. The results are plotted on a graph (Fig. 6).

When the normal person at exercise requires more air he gets the increased amount chiefly by increasing the depth of breathing. The depth of each respiration is increased with little change in the rate of breathing. A person with respiratory disability can increase his depth of breathing only to a very limited extent. When he requires more air, he is compelled to increase his respiratory rate.

CONCLUSIONS

(1) The disability in silicotics is due to inadequate oxygen supply, the result of thickening and rigidity of the pulmonary alveolar walls and the associated emphysematous changes together with edema of the air sacs and terminal bronchioles and engorgement of the capillaries surrounding these structures.

(2) Disability cannot be interpreted by the degree of nodular fibrosis shown on an x-ray film.

(3) The degree of dysfunction of the lungs in pulmonary fibrosis is measured most accurately by respiratory function tests.

Washington, Penna.

Evaluation of Disability in Low Back Injuries[1]

FORREST L. SCHUMACHER, M.D.

Pittsburgh, Pa.

DISABILITY VARIES directly with the loss or alteration of function. This loss or alteration of function may be a result of injury, disease, congenital malformations, or new growths. It may be temporary, progressive, or permanent. In evaluating disability in industry for compensation purposes it is obvious, then, that we must separate disease, congenital anomalies, and new growths from trauma.

In the past ten years the cases of low back injuries that we have seen in compensation courts have far outnumbered lesions in other parts of the body. It is comparatively simple to estimate the amount of disability in the more serious injuries. We know what to expect from a fractured vertebra; we also know that, if there are a fracture and dislocation, the period of disability will be prolonged. Once a diagnosis of a displaced nucleus pulposus is established, we know the remedy, but in those cases which are entirely negative except for the subjective symptom of pain it is extremely difficult to evaluate disability.

When such cases appear in compensation courts, the history is usually of a more or less trivial accident with or without immediate disability. The symptoms are, invariably pain referred to the low back with or perhaps without sciatic radiation. There is seldom any evidence of contusions or abrasions. The physical examination is negative except for the painful area somewhere in the region of the posterior superior spine. The expression "somewhere" is used intentionally, because the location is not always the same when the patient is examined in different positions.

The evaluation of disability requires the application of medical principles of diagnosis not unlike those in the diagnosis of disease (McBride). It begins with an attempt to recreate the mechanics of the accident (Lasher) and, as Ellis says, an exhaustive anamnesis. The mere fact that a hearing is held assumes that there has been an accident. The history and recreation of the mechanics represent an attempt to correlate the physical findings with that accident, to prove that injury did occur.

McBride defines an accident as "an event that takes place without one's foresight or expectation; an event proceeding from an unknown cause; something happening by chance, a mishap." In medical practice it means "an unlooked-for event happening more or less suddenly without design and producing physical injury."

Unfortunately for us, we do not get to see these low back cases soon after the injury. In most instances we have seen the patient because he has remained away from work far longer than the usual period (Table I). In the interval he has been through the hands of the "company doctor," perhaps the family physician, and maybe a specialist or two. By the time he reaches us, all evidence of contusions and abrasions, hematomas, etc., has disappeared. Muscular spasm may be present but usually is not. Because of this, the physical examination must be carried out in the most minute detail. The patient should be entirely undressed, and examinations made in all positions, standing, sitting, prone, supine, and even in the lateral positions. The examiner should be familiar with the various tests to differentiate between hip-joint, lumbosacral and sacro-iliac disease. A diagnosis once arrived at makes the evaluation much simpler.

Simple muscular or ligamentous strain is the most common industrial injury (Kessler). It varies in intensity, as do all other injuries. Chronic strain is perhaps

[1] Presented, as part of a Symposium on Correlation of Disabilities with Roentgen Findings, before the Radiological Society of North America, at the Twenty-eighth Annual Meeting, Chicago, Ill., Nov. 30–Dec. 4, 1942.

next in order; then rupture of a muscle or ligament. Any combination of the above may occur, plus involvement of joints.

In many of the cases we see, a diagnosis of sacro-iliac sprain has been made. It is our contention in these cases that, since there was no direct trauma to the part, nor was there actual physical contact between the workman and an object, the sprain or strain is not the result of accident but is more than likely the result of disease, and therefore is not compensable. In this respect it is interesting to note the decision of the Oklahoma Supreme Court in the case of National Biscuit Co. vs. Lout—Okla. 65P (2d) 497 (1936)—as quoted by Kessler:

A workman was employed in a warehouse moving barrels and other articles of merchandise. He stooped to reach a barrel and was seized with a sudden sharp pain in his back and left leg. Temporary total disability resulted. The State Industrial Commission made an award in favor of the workman, and the company instituted original proceedings in the Supreme Court of Oklahoma to obtain a review of that award. The question presented to the Court was whether or not, under the circumstances, the workman sustained an accidental injury within the meaning of the Workmen's Compensation Act. An examination of cases previously decided in Oklahoma, said the Court, discloses that where a finding of accidental injury has been sustained there has been evidence to the effect that it was the result of some external cause although there was no trauma or external manifestation of injury. In the present case the Court was asked to go a step further and to hold accidental a "muscle strain," which according to the evidence happened apparently without cause other than the act of stooping over to perform work. In other words, the Court was asked to say that an act which required no unusual exertion, which presented no sudden strain on the workman's muscle but in every way was the normal and usual function of his body, except for the resulting disorder, should be deemed an accident. If we should so hold, the Court continued, we must be prepared to hold that every muscle or nervous strain which an employee sustains and which results in a disability is accidental regardless of any apparent external cause or stimulus producing such conditions. So to hold would in effect nullify rather than construe the provisions of the Workmen's Compensation law. The most that can be said of the workman's evidence, the Court concluded, is that he sustained a "muscular strain" for no apparent reason except that he stooped over. To say that it was accidental merely because it was unexpected would be to authorize a judgment based on conjecture, surmise, and speculation. Under such circumstances the Court concluded that there was no competent evidence before the commission on which to base its findings of accidental injury, and that therefore the commission was without jurisdiction to make any award. The award of the commission was vacated for want of any competent evidence to support it.

TABLE I. AVERAGE NORMAL HEALING PERIOD IN BACK INJURIES

	Approximate period immobilization or surgical care	Approximate end observation and treatment	Able to begin work
Strain, traumatic	2 weeks	3 weeks	4 weeks
Muscle or ligamentous rupture	4 weeks	5 weeks	10 weeks
Contusion deep severe bruise	1 week	2 weeks	2 weeks
Sacro-iliac subluxation, "painful catch"	2 weeks	4 weeks	5 weeks
Acute lumbago, fibrositis	2 weeks	3 weeks	4 weeks
Chronic lumbago, fibrositis	10 weeks	12 weeks	20 weeks
Bursitis, acute	2 weeks	3 weeks	3 weeks
Bursitis, chronic	6 weeks	10 weeks	15 weeks
Sciatica, acute	6 weeks	8 weeks	10 weeks
Sciatica, chronic	10 weeks	12 weeks	20 weeks
Osteoarthritis, progressive	24 weeks	46 weeks	52 weeks

Another diagnosis with which we are often confronted is "arthritis aggravated by injury." There is no word in our nomenclature that is misused more that the word "arthritis," nor is there any word that is more likely to befog the medico-legal picture. Arthritis does occur in the spine, but it must be remembered that it can occur only in true diarthrodial joints, and of these the only ones in the spine are those between the inferior articular proc-

esses of a vertebra and the corresponding facets of the vertebra next below. We have learned much of these arthritides from the writings of Hubeny, Kirklin, and Ghormley. In a signed editorial in RADIOLOGY A. W. George has given a splendid dissertation as to the correct terminology.

The clinician or the orthopedic surgeon, as the case may be, having made his exhaustive physical examination, now asks for a roentgen study to complete the picture. Our routine is to use large film for the two views of the lumbar spine and the pelvis. Smaller film is used for the lumbosacral segment seldom produce disability, and it is a question whether they prolong the disability after an accidental injury. Likewise hypertrophic spurs are mentioned only to be dismissed as the ordinary result of wear and tear on the spinal ligaments. Reputable physicians have been known to testify in court that these hypertrophic spurs are the results of accident and that they produce pain by impinging on the spinal nerves. We know from the work of Oppenheimer that most of these spurs originate at or about puberty and that it takes years for them to form. We also

TABLE II: RATINGS FOR BACK INJURIES BASED ON FUNCTIONAL SEQUELAE (KESSLER)

	Per cent total disability
1. Simple muscle strains, uncomplicated	0 to 5
2. Simple muscle strains, complicating mild hypertrophic changes	5
3. Simple muscle strains, complicating extensive hypertrophic changes	10 to 15
4. Sacro-iliac sprains, average case	0 to 5
5. Sacro-iliac sprains with mild sequelæ (functional)	10 to 15
6. Sacro-iliac sprains with severe sequelæ (functional)	20 to 25
7. Lumbosacral sprains, average case	0 to 5
8. Lumbosacral sprains, with mild sequelæ	10
9. Lumbosacral sprain, with severe sequelæ (spondylolisthesis)	25
10. Fracture of one transverse process, lumbar	0 to 5
11. Multiple fractures of transverse processes, with mild functional sequelæ	10
12. Multiple fractures of the transverse processes, with severe functional sequelæ	15 to 25
13. Fracture of cervical vertebræ (depending upon functional sequelæ)	5 to 25
14. Compression fracture of dorsal or lumbar vertebræ (depending upon functional sequelæ)	25 to 50
15. Cord symptoms, with or without fracture	25 to 100
16. Fracture of sacrum	5 to 15
17. Fracture of coccyx	5 to 10

sacral joint and the lower edge of the fifth lumbar. This is called the Williams position, though the writer is certain that it had been used and reported previously by Hess. We like the large film because we have saved ourselves some embarrassment in discovering pathological conditions which we would have missed had small film been used. When oblique views are required we again use small film.

In a great majority of the cases of low back pain the roentgen examination is negative. We habitually report anomalies when seen. In our opinion the ordinary anomalies of the last lumbar and first

know, from the studies of Shore, that they are calcifications within the intervertebral ligaments and that the anterior and posterior common ligaments are seldom involved. A study of any standard textbook of anatomy will soon dispose of the theory that they can "impinge" on a spinal nerve. Fractures of hypertrophic spurs do occur, and the accompanying trauma does aggravate the condition somewhat, but the hypertrophic process was there and it will remain there and continue to progress while the effects of the trauma will be repaired in a short time. Possibly there is some limitation of motion but Oppenheimer says that

TABLE III. DISABILITY EVALUATION

(From Table 61 in McBride: Disability Evaluation, J. B. Lippincott, 1942)

Clinical Factors Contributing to Disability	Quickness, Speed, Alertness Value 10%		Coordination, Correlation, Arms, Legs, Body Value 20%		Strength, Power, Leverage Value 20%		Security, Reliability, Confidence, Control Value 10%		Endurance, Stability, Toleration Value 20%		Safety as a Workman Value 10%		Prestige of Physique, Chance of Employment Value 10%		Total Value of Body 100%
	Delayed action	Loss	Awkwardness	Loss	Weakness	Loss	Insecurity	Loss	Fatigue	Loss	Increased risk	Loss	Averse influence	Loss	Per cent Loss to Body (Sum of Factor Losses)
C. Contusions or sprains involving spinal ligaments and fascia, in actual rupture of continuity															
I. Final recovery to extent of good strength, free motion, no muscle spasm and pain up to 75% of normal															
a. Cervical region	5%	0.5	10%	1.0	10%	2.0	10%	1.0	15%	3.0	5%	0.5	5%	0.5	8.5
b. Thoracic region (above 10th)	5%	0.5	10%	1.0	10%	2.0	10%	1.0	15%	3.0	5%	0.5	5%	0.5	8.5
c. Lumbar region	10%	1.0	15%	1.5	15%	3.0	15%	1.5	20%	4.0	10%	1.0	10%	1.0	13.0
d. Ilio-lumbar region	10%	1.0	15%	1.5	15%	3.0	15%	1.5	20%	4.0	10%	1.0	10%	1.0	13.0
e. Lumbo-sacral region	15%	1.5	15%	1.5	15%	3.0	15%	1.5	20%	4.0	10%	1.0	10%	1.0	13.5
f. Sacro-iliac region	10%	1.0	20%	2.0	25%	5.0	20%	2.0	30%	6.0	15%	1.5	15%	1.5	19.0
D. Chronic fibrositis or osteoarthritis (chronic strain), involving spine, muscles, ligaments and fascia, in intermittent exacerbations of a rheumatic nature															
I. Total spine	75%	7.5	75%	15.0	85%	17.0	75%	7.5	60%	12.0	60%	6.0	75%	7.5	72.5
II. Final recovery to extent of good strength, free motion. No muscle spasm and no pain up to 75% normal															
a. Cervical region	15%	1.5	25%	5.0	20%	4.0	30%	3.0	40%	8.0	10%	1.0	15%	1.5	24.0
b. Thoracic region (above 10th)	10%	1.0	20%	4.0	30%	6.0	30%	3.0	45%	9.0	10%	1.0	10%	1.0	25.0
c. Lumbar region	20%	2.0	30%	6.0	35%	7.0	40%	4.0	50%	10.0	20%	2.0	25%	2.5	33.5
d. Ilio-lumbar region	15%	1.5	25%	5.0	35%	7.0	35%	3.5	45%	9.0	15%	1.5	20%	2.0	29.5
e. Lumbo-sacral region	15%	1.5	25%	5.0	35%	7.0	35%	3.5	45%	9.0	15%	1.5	20%	2.0	29.5
f. Sacro-iliac region	10%	1.0	20%	4.0	30%	6.0	35%	3.0	45%	9.0	15%	1.5	10%	1.0	25.5
III. Final recovery to extent of good strength, free motion. No muscle spasm and no pain up to 50% normal															
a. Cervical region	30%	3.0	30%	6.0	30%	6.0	40%	4.0	50%	10.0	20%	2.0	25%	2.5	33.5
b. Thoracic region (above 10th)	20%	2.0	25%	5.0	40%	8.0	40%	4.0	55%	11.0	15%	1.5	20%	2.0	33.5
c. Lumbar region	35%	3.5	40%	8.0	45%	9.0	45%	4.5	60%	12.0	25%	2.5	25%	2.5	42.0
d. Ilio-lumbar region	30%	3.0	45%	9.0	50%	10.0	40%	4.0	55%	11.0	20%	2.0	20%	2.0	41.0
e. Lumbo-sacral region	30%	3.0	45%	9.0	50%	10.0	40%	4.0	55%	11.0	20%	2.0	20%	2.0	41.0
f. Sacro-iliac region	20%	2.0	20%	4.0	30%	6.0	30%	3.0	45%	9.0	20%	2.0	20%	2.0	28.0
IV. Final recovery to extent of good strength, free motion, no muscle spasm and no pain up to 25% normal															
a. Cervical region	50%	5.0	50%	10.0	40%	8.0	65%	6.5	65%	13.0	40%	4.0	40%	4.0	50.5
b. Thoracic region (above 10th)	35%	3.5	35%	7.0	50%	10.0	65%	6.5	70%	14.0	30%	3.0	30%	3.0	47.0
c. Lumbar region	60%	6.0	65%	13.0	75%	15.0	75%	7.5	75%	15.0	50%	5.0	40%	4.0	65.5
d. Ilio-lumbar region	50%	5.0	70%	14.0	80%	16.0	70%	7.0	70%	14.0	45%	4.5	35%	3.5	64.0
e. Lumbo-sacral region	50%	5.0	70%	14.0	80%	16.0	70%	7.0	70%	14.0	45%	4.5	35%	3.5	64.0
f. Sacro-iliac region	35%	3.5	30%	6.0	40%	8.0	50%	5.0	60%	12.0	35%	3.5	30%	3.0	41.0

these calcifications form where there is the most relaxation and that they represent an attempt to stabilize the part.

With the history of the accident and physical and roentgen examinations completed, we now come to their correlation and the evaluation of the disability.

We have said that the evaluation of disability depends on the loss or impairment of function. A workman who performs his duties daily with a reasonable degree of accuracy and dispatch may be assumed to be 100 per cent efficient. There must be some standard for comparison. McBride

TABLE IV: AN ANALYSIS OF THE FACTORS WHICH COMPOSE FUNCTION AND THEIR APPROXIMATE RELATIONSHIP IN TERMS OF PERCENTAGE AS APPLIED TO DISABILITY (McBRIDE)

Normal Part

Functional capacity

Pinching, grasping, reaching, kicking, springing, stepping, pushing, pulling, lifting, holding, throwing, carrying, swinging

Factors of 100 per cent working capacity

Percentage value of each

10	20	20	10	20	10	10
Quickness	Co-ordination	Strength	Security	Endurance	Safety	Physique

Disabled Part

Clinical findings of impairment

Tenderness, Muscle spasm, Ankylosis, Shortening, Atrophy, Paralysis, deformity

Functional incapacity

Percentage value of each

10	20	20	10	20	10	10
Slow action	Awkwardness	Weakness	Insecurity	Fatigue	Increased risk	Impaired prestige
% loss	% loss	% loss	% loss	% loss	% loss	% loss

Total Percentage Partial Disability

uses schedules which represent 100 per cent, while Kessler is less inclined to the mathematical standard. He objects to schedules because of their lack of uniformity, relative values, their scope, and their lack of a basis for partial disabilities. It is obvious that a workman twenty years old will not be disabled as long as one forty to fifty years old. Nor will a well proportioned person be as long recovering as a tall, thin or a short, fat workman. It is just as certain that one having that peculiar diathesis that predisposes to backache will not recover as soon as one who is not subject to it.

The end-result in low back injuries is manifested in two functional conditions: (1) limitation of motion; (2) impairment of strength.

Generally speaking normal forward flexion of the trunk is 95 degrees; extension, 35 degrees; lateral flexion, 40 degrees; rotation, 35 degrees. Since flexion and extension are in the same plane, they can be considered as one, giving a range of motion of 130 degrees. If this range of motion is impaired 20 per cent and lateral flexion 10 per cent, then Kessler says the maximum, or the 20 per cent, should be considered as the impairment. If loss of lifting power is 10 per cent, he accepts the larger figure—in this case 20 per cent impairment of function. (See Table II.)

McBride goes farther in that he breaks function up into its component parts: quickness of action, co-ordination of movements, strength, security, endurance. To these he adds, for industrial purposes, safety as a workman and prestige of normal physique in securing employment. (See Table IV.) The total sum of these components is given as 100 per cent. Each factor is considered and its percentage noted; the sum total is the percentage of disability evaluated. (See Table III.)

Both these systems have their advantages; both furnish a sound working basis for computing disability.

601 Jenkins Building
Pittsburgh, Penna.

REFERENCES

ELLIS, JOHN D. (editor): The Injured Back and Its Treatment. Springfield, Ill., Charles C Thomas, 1940.

GEORGE, A. W.: Use and Abuse of the Term Hypertrophic Arthritis Relative to Marginal Changes in the Vertebrae. Radiology **36:** 745–746, June 1941.

GHORMLEY, R. K., AND KIRKLIN, B. R.: Oblique View for Demonstration of Articular Facets in Lumbosacral Backache and Sciatic Pain. Am. J. Roentgenol. **31:** 173–176, February 1934.

HUBENY, M. J.: Oblique Projection in Examination of the Lumbar Spine. Radiology **16:** 720–724, May 1931.

KESSLER, HENRY H.: Accidental Injuries: Medico-Legal Aspects of Workmen's Compensation and Public Liability. Philadelphia, Lea & Febiger, 2d ed., 1941.

LASHER, W. W.: Acute Back Injuries. Am. J. Surg. **23:** 297–304, February 1934.

LASHER, W. W.: Industrial Surgery. New York, Paul B. Hoeber, Inc., 1942.

McBRIDE, EARL D.: Disability Evaluation: Principles of Treatment of Compensable Injuries. Philadelphia, J. B. Lippincott Co., 3d ed., 1942.

OPPENHEIMER, A.: Diseases of Apophyseal (Intervertebral) Articulations. J. Bone & Joint Surg. **20:** 285–313, April 1938.

SHORE, L. R.: Polyspondylitis Marginalis Osteophytica. Brit. J. Surg. **22:** 850–863, April 1935.

Correlation of Disability with Roentgen Findings The Extremities[1]

E. C. BAKER, M.D.

Department of Radiology, Youngstown Hospital Association, Youngstown, Ohio

THE TITLE OF this symposium suggests various ideas and numerous methods of approach. Certain premises seem to be evident and should be stated before attempting to work out the main thesis. If we are able to correlate roentgen findings with disability, we are able to give prognoses to the physicians referring us cases. The rendering of such prognoses is in the realm of consultation. Certainly, that is the class in which roentgenologists should move. When we acquire and use the knowledge that is necessary for consultation, we advance Radiology by rendering more service to the patient and the attending physician.

In such correlation as we are attempting, another premise is important. It is taken for granted that our diagnostic ability with roentgen procedures exceeds the diagnostic ability of the physicians who examine the patient without benefit of such procedure. Accurate diagnosis plus general medical knowledge immediately gives us a definite prognosis in many types of pathology. The preceding statement gives the clue to the most commonly used method of such correlation as we are attempting. This consists in the pooling of information obtained by one method, such as x-ray study, with the clinical progress of the case and with any pathological evidence obtainable. Perhaps all of our general medical knowledge is so obtained.

A number of conditions will be considered to which the contribution of the roentgenologist is the diagnosis. General medical knowledge supplies the prognosis or the extent of disability. An attempt will be made to use roentgen methods alone to bring out medical facts of prognostic significance. If we investigate the re-examinations of fractures which we have made and find that a few types predominate, we have definite information that such fractures are more difficult to treat or are longer in healing than the ones not re-examined. Again, if we find from our records that a few bones are the ones most frequently operated upon for reduction of fracture, we can postulate that fractures of these bones are likely to produce a longer period of disability than those not needing operation. (In speaking of fracture operations, we are considering the ordinary hospital and not the occasional extraordinary clinic where operative procedures on bones are routine.) A little later we shall name a few of the types of fractures which, from a roentgenologic point of view, appear to be most unfavorable. The third group of cases which will be discussed represents the result of clinical experience. Most of this group furnish diagnostic problems which many times we neglect or give too little attention.

The first group of cases, in which roentgenologic diagnosis combined with general medical knowledge gives a fairly definite prognosis, includes a variety of pathologic conditions. The recognition of a Charcot joint tells us immediately that the patient has a syringomyelia or syphilitic involvement of the spinal cord. The bone and joint destruction shown on the film may heal, with partial re-organization of tissue, but disability is permanent. Different types of arthritic change are frequently best differentiated by x-ray examination. In patients with a severe rheumatoid arthritis, the disability is obvious on the film. When the joint space is narrowed, due to the destruction of cartilage, which

[1] Presented, as part of a Symposium on Correlation of Disabilities with Roentgen Findings, before the Radiological Society of North America, at the Twenty-eighth Annual Meeting, Chicago, Ill., Nov. 30–Dec. 4, 1942.

we are certain from our medical knowledge will not regenerate, we unquestionably have permanent disability. Tuberculosis of bones or joints when advanced to such a stage as to cause obvious destruction of bone or loss of cartilage may eventually heal after prolonged treatment, but sequelae are inevitable.

TABLE I: EXAMINATIONS AND RE-EXAMINATIONS IN FRACTURE CASES

Total examinations	10,068
Number of fractures	6,523
Number of re-examinations	3,545
Number of fractures of extremities	4,524
Number of re-examinations of extremities	2,986

Bone	Fractures	Re-examinations
Tibia and fibula	623	929
Femur	409	695
Humerus	611	480
Tibia	276	161
Patella	79	48
Radius and ulna	931	330
Os calcis	75	29
Ulna	108	35
Fibula	198	41
Foot	276	50
Hand	390	79
Clavicle	335	57
Radius	532	79
Scapula	50	3

The diagnosis of bone sarcoma is often first made by the roentgenologist. Such diagnosis is of the gravest import. In many places this label seems to amount to a death sentence. Fortunately, some of these patients can be cured. Giant-cell tumors mean disability even with the best of treatment. Such tumors, if of the malignant variant type, have a most serious prognosis. The position of these tumors helps in the diagnosis. It also shows why some joint impairment usually follows treatment.

Osteomyelitis is at present in a very unsettled state. The old statement "once an osteo, always an osteo" may have to be revised in light of experience with the sulfa drugs, though a warning should be issued here. We have seen two patients within the last year who, after treatment with one of the sulfa drugs, definitely improved and became apparently well, clinically. One of these had a recurrence of symptoms months later, and roentgen examination showed that the disease had never stopped but had continued to progress. The other

TABLE II: RE-EXAMINATIONS IN FRACTURES OF THE LOWER EXTREMITY

Femur	100 Re-examinations
Head	1
Neck	19
Trochanters	10
Upper third	4
Middle third	57
Lower third	7
External condyle	1
Internal condyle	1
Tibia and Fibula	300 Re-examinations
Tibia	
Head	11
Upper third	53
Middle third	92
Lower third	89
Internal malleolus	58
Fibula	
Head	20
Upper third	54
Middle third	69
Lower third	110
External malleolus	41
Epiphyseal line	2

case also showed continued progress roentgenologically associated with clinical cure. Both patients were operated upon because of the advancing bone destruction. Certainly, however, all of us are seeing a number of cases of osteomyelitis which apparently clear both clinically and roentgenologically following the use of one of the sulfa drugs. Diagnosis of Garré's osteitis carries with it usually an excellent outlook. Treatment with x-rays seems to be fairly specific. Many other conditions of the extremities best recognized by x-ray examination could be presented in this group.

In the second group of cases prognosis is aided by statistical evidence obtained from the grouping and breaking down of roentgen examinations and re-examinations. The tables present the evidence. When the roentgenologist is requested to make a second or subsequent examination in a case of known fracture, it usually means that the position of the fragments has not been satisfactory or information is needed as to healing. In either case the re-examined fracture is more serious, or is causing more trouble, than one that requires only a single roentgen examination for diagnosis.

The accompanying tables are based on examinations in our department covering approximately a six-year period. These

TABLE III: RE-EXAMINATIONS OF THE UPPER EXTREMITY

Humerus	100 Re-examinations
Head	1
Tuberosities	4
Neck	9
Upper third	18
Middle third	16
Lower third	39
External condyle	9
Internal condyle	4
Radius and Ulna	100 Re-examinations
Radius	
Head	6
Upper third	11
Middle third	33
Lower third	50
Epiphyseal line	1
Ulna	
Olecranon process	1
Coronoid process	2
Upper third	7
Middle third	34
Lower third	19
Styloid process	35
Epiphyseal line	2

tabulations are not recent but were made six or seven years ago. As can be seen, the number of re-examinations is slightly more than half the number of original examinations. The percentage is somewhat higher when the extremities alone are considered.

Table I deals altogether with the extremities. As shown in this table, re-examinations of the tibia and fibula and of the femur number approximately 150 and 175 per cent of the original examinations. For the humerus the percentage of re-examinations is approximately 66 per cent; for the tibia somewhat less than this; for the patella about 60 per cent; for the radius and ulna about 35 per cent, and so on down the line, with a decrease in percentage in the other bones.

In Table II, 300 re-examinations of the tibia and fibula are listed. For both bones the largest number were for fractures of the middle and lower thirds. In other words, fractures involving the middle and lower thirds of the tibia and fibula require many more re-examinations than most of the other types of fractures that we see. With the femur, the middle third predominates; with the humerus (Table III) the lower third.

In an attempt to get at this matter in another way, we have listed in Table IV 206 consecutive cases (comparatively recent) in which operation was required. From this we find that the upper and middle portions of the femur are the two areas that are most commonly operated upon in our hospital. The tibia again shows the middle and lower thirds predominating, and the humerus the lower third. The proximal and middle thirds of the radius are the important sites. Most of the operations on the hand listed in Table IV are amputations. The operations on the patella can be considered as repairs of a tendon rather than as actual bone operations.

TABLE IV: FRACTURES TREATED BY OPERATION

Femur		
Upper end	11	
Middle	13	
Distal end	4	
Patella	5	
Tibia		
Upper end	6	
Middle	18	
Lower end	32	
Fibula		
Upper end	1	
Middle	3	
Lower end	5	
Foot		
Tarsal bones	1	*2
Ankle	5	
Humerus		
Upper end	2	
Middle	2	
Lower end	12	
Radius		
Proximal end	13	
Middle	21	
Distal end	8	
Ulna		
Proximal end	14	
Middle	6	
Distal end	12	
Hand		
Carpal bones	1	
Thumb	1	*2
Index finger	*2	
Middle finger	*2	
Ring finger	*1	
Little finger	*1	

* Amputation.

Most of this evidence fits in accurately with the evidence which was found in re-examining fractures. The neck of the femur is pinned much more frequently than was done a few years ago and that, I believe, accounts for the increase in operations in this portion of the femur. Again, we see that the middle third of the femur and the middle and lower thirds of the

tibia and fibula are the two areas where fracture of bone is likely to be prolonged and serious.

To call by name a few of the fractures which, in our experience, have been the ones to give trouble, I will mention first the transverse fracture of the femur. This has usually been slow to heal even though apposition has been accurate. In fractures of the middle and lower thirds of the tibia and fibula, whether transverse, oblique, or spiral, healing is likely to be prolonged. If these fractures are compound, the delay may be still greater. The severe dislocation fractures of the ankle are frequently easy to reduce but extremely difficult to hold in position and require a long time for proper healing and for return of function. In fractures in the region of the elbow joint and in the lower third of the humerus convalescence is also likely to be prolonged and active physiotherapeutic measures required to bring about functional restoration.

Dislocations, I think we as roentgenologists are inclined, with the surgeons, to regard too lightly. I know this is true of the hip. Every hip dislocation occurring before twenty-five years of age that we have been able to follow has resulted, in the course of the next few years, in a deformity of the femoral head and an appearance resembling an osteochondritis. This causes real and lasting disability. When fracture of the rim of the acetabulum or fracture of the head of the femur has occurred, the disability is worse than with dislocation alone. Certainly, we should be more guarded in our prognosis of disability with dislocation.

Not infrequently we see about the elbow multiple epiphyseal tears that result from or occur with dislocation of the elbow. These are frequently difficult to show and yet require a very guarded prognosis. Many heal without trouble. Others when least expected will throw out excess callus and will present real problems in management if return of function is to be complete. One measure that has helped us frequently is x-ray therapy, in small doses, after the callus shows fair union. This can be used to help restore motion in the ordinary diacondylar and supracondylar fracture of the elbow. Irradiation cuts down excess callus and seems to have a favorable effect on the accompanying myositis. Such therapy should not be used too early, however, or adequate callus formation may be hindered. We have seen no ill effects after the callus is well formed.

Fractures of both bones of the forearm in the middle third are extremely difficult to hold and often require surgery for reduction. Experience with many fractures frequently enables the roentgenologist to predict from fluoroscopic study, or at times from the film alone, that the end of one of the fragments is caught in muscle and that closed methods of reduction will fail.

Prognosis in the individual case is an exceedingly difficult task. Group statistics on length of time required for healing of the bone are valuable and form a standard for guidance, but individual cases frequently vary from the average, in our experience, by many weeks or months. Our prognosis should be guarded and in most cases be rather general in character. Frequently, the roentgenologist is the one who can best determine the degree of healing and progress of a fracture. Here, again, I believe we should be conservative in estimating the amount and density of the callus. Certainly, the pronounced decalcification which is seen following fractures, especially when there has been severe soft tissue damage, is best recognized by the roentgenologist. Sometimes secondary bone atrophy is very painful and convalescence is sure to be prolonged when it occurs. We have had a few of these cases respond to measures used in peripheral vascular disease. Fractures through diseased bone require a very guarded prognosis. In some cases healing seems to be accelerated but the actual callus is soft and not capable of sustaining any real stress.

The third and last group of cases which I wish to mention consists of conditions of

the extremities which frequently are not noted even when shown on the films. Reports usually fail to mention these. Minor degrees of periosteal reaction, for example, may not be noted. Such reaction, especially when seen in the bones of the extremities, may be a clue to chest disease. It appears to be a non-specific reaction that arises from chronic chest conditions of a number of different types. It is not metastatic in nature and may occur along the shaft of a long bone or close to a joint. Calcification of the arteries, which is frequently seen, especially on soft tissue films, may not be mentioned in x-ray reports; yet it is of great importance in some fractures, in gangrene of the toes, diabetic or otherwise, and in the treatment of peripheral vascular disease. Venography of the lower extremity has proved of great significance, in our experience, in acute and chronic phlebitis. This valuable procedure, however, is as yet used rather infrequently.

Some of the soft tissue injuries which we see in connection with joints can best be illustrated in the knee. If an air injection of a knee joint is done, especially when it has been the site of a chronic synovitis, the extensive ramifications of the joint and its extent will be appreciated as never before. The knee joint space is really quite large. It extends above the patella and laterally on either side of it, while posteriorly it may extend up along the posterior portions of the condyles of the femur. When we do not find a fracture of the knee, we frequently give a negative report, forgetting that the obvious swelling seen posterior to the patella and in the region of the knee joint space represents fluid in the joint. Such fluid should be reported. The prognosis is certainly different with and without fluid. With a little care and watching, we can discover relatively small amounts of fluid in other joints. Frequently, a little fluid in the joint can be diagnosed by the haziness and fuzziness of the joint structures. To make this diagnosis, it is essential that films be not over-exposed.

The swelling resulting from a bursitis anterior to the patella is easily diagnosed from the film alone. Infections in the soft tissues outside the joint may be seen with no evidence of fluid in the joint. Obviously such a condition carries a different prognosis than if the joint were affected. We believe it is frequently possible to differentiate between hemorrhage and edema in the soft tissues. Hemorrhage has a peculiar striated, irregular appearance, whereas edema gives a cross-hatched, rather regular picture. Study of the soft tissues has compensations in the diagnosis of a few serious injuries. Tears of the lateral ligaments of the knee can occasionally be diagnosed from soft tissue studies. Tears of the patellar tendon, either above or below the patella, can be seen on the roentgen film, and the surgeon be advised as to the lesion present.

Sprain fractures, in which we see a small chip of bone or a periosteal tear resulting from a small tear where the ligament is attached to the bone, are quite frequently neglected. If we study the soft tissue swelling around the joint, we are often able to discover these small sprain fractures. Obviously a negative report and a report of sprain fracture carry entirely different prognoses. Such fractures have been treated with increasing respect in our hospital. Frequently, the patient is immobilized for several weeks with a plaster cast. The result appears to be very much worth while. Instead of remaining unstable for weeks afterward, the ankle has a chance to heal and become as strong as before.

Diagnosis of hemorrhage in the soft tissues and in the muscular tissues is especially important in connection with wringer accidents. All of us see some of these cases each year. In most of them the report is negative, for seldom do we find fractures of any of the bones. If, however, careful study is made of the films, we will find that the muscular tissues show evidence of considerable hemorrhage or actual distortion of the muscle bundles because of hemorrhage within these, and there is

evidence of hemorrhage in the subcutaneous tissues. We know that these injuries lead to prolonged disability and it seems fair that we should call attention to this hemorrhage in our report. Following some of these cases, one finds that occasionally calcification occurs and a myositis ossificans results. Here, again, x-ray therapy can be used to decrease the amount of calcification and reduce the accompanying myositis. The period of disability can thus be cut down appreciably.

SUMMARY

Three groups of cases in which a definite prognosis can be made on the basis of the roentgen picture have been presented. By the use of purely roentgen statistics, some information has been obtained as to what fractures carry unfavorable prognoses.

Finally, I would make a plea for more interest in soft tissue pathology with a resultant improvement in our prediction of disability.

Youngstown Hospital Association
Youngstown, Ohio

The Postero-mesial Pleural Line

L. HENRY GARLAND, M.D.

San Francisco

SEVERAL MONTHS ago there appeared in RADIOLOGY an editorial (1) entitled "The Linear Thoracic Paraspinal Shadow." This editorial dealt with the question of the correct interpretation of a slender marginal line of demarcation sometimes visible in sagittal roentgenograms of the lower posterior thorax, especially on the left side. It was suggested that the true nature of this line had not been clarified and that it might possibly be due to an anomalous vascular structure.

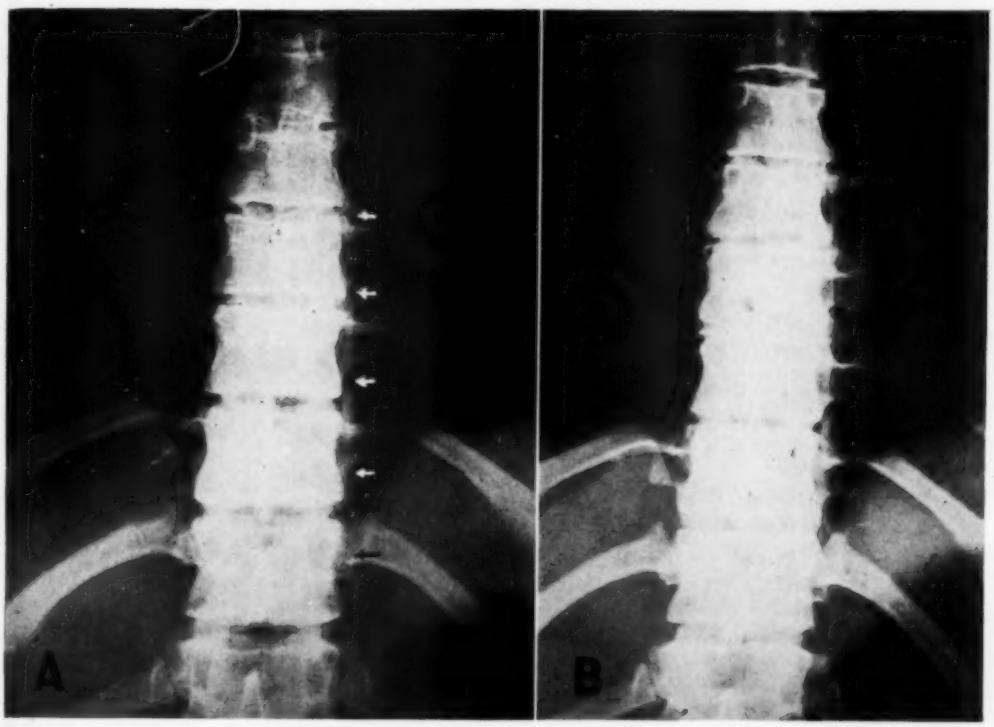

Fig. 1. Two roentgenograms of same subject showing the postero-mesial pleural line. In A the line is marked by arrows. Note that the line is visible only on the left side of the thoracic spine in this patient. In the original roentgenograms it could be seen extending from the level of the 6th to the level of the 11th thoracic bodies. The patient was a healthy adult female of thirty years.

Within a few weeks some 6 letters were received offering various alternative explanations for the line in question. These were kindly forwarded by the Editor to the persons who perpetrated the editorial in question! The first letter reads: "We dissected a cadaver twenty years ago, taking straight anteroposterior films with each stage of dissection, removing successively the sternum, heart, aorta, esophagus, veins, lymphatics, etc. The paravertebral line on the left in this case was due to the fascia in which the esophagus and posterior mediastinal structures lie. We called this a paravertebral fascia line, but mediastinal-pleural line would be just

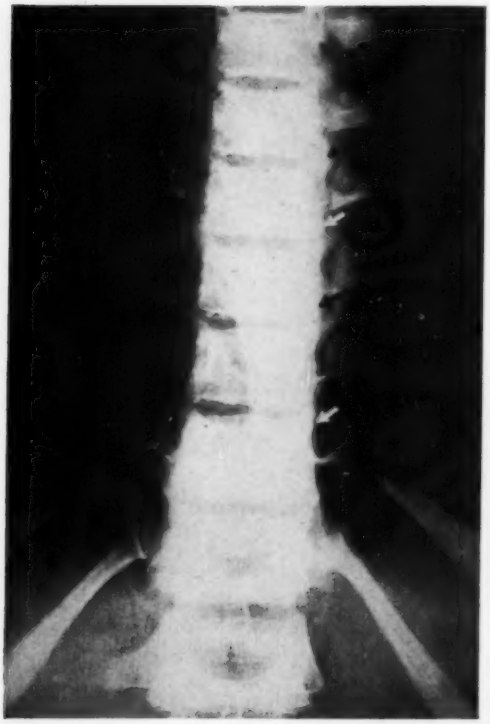

Fig. 2. Postero-mesial pleural line on the left side of the lower thoracic spine of a child twelve years of age.

as good a definition." Well, we ourselves had made radiographic studies of cadavers some fourteen years ago and compared the postmortem films with the anatomical and pathological findings at autopsy. We did not feel that the method was a completely satisfactory one for identifying structures of the type under review but, as a matter of fact, we were not at the time studying that particular question.

The next correspondent stated that the line was unquestionably due to a pleural reflection and cited the illustration appearing in Schinz's textbook of *Roentgen Diagnosis* (page 485, 1928 edition). This illustration does show a paravertebral line, but one which is separated from the spine by a distance of some 10 or 12 mm. and does not at all resemble the line we were discussing.

A third correspondent, from Canada, reported that he had found no satisfactory explanation for the line and hoped that further contributions would be offered in regard to its correct identification. Two other correspondents made much the same comment.

The sixth correspondent (2) identified

Fig. 3. Postero-mesial pleural line on the left side of an adult male of twenty-five. A faint trace of a line on the right side of the lower thoracic spine is visible, but the line is more clearly seen on the left, as is usual. In none of the cases illustrated was there any clinical or other evidence of pleural or pulmonary disease.

the line as the posterior margin of the visceral or parietal pleura and submitted a most informative reprint in support of his thesis. He states therein that the posterior mediastinal boundaries of the lungs and pleurae appear in the lower thoracic region as longitudinal linear shadows closely paralleling the lateral borders of the spinal column, and are more commonly seen on the left than on the right. These

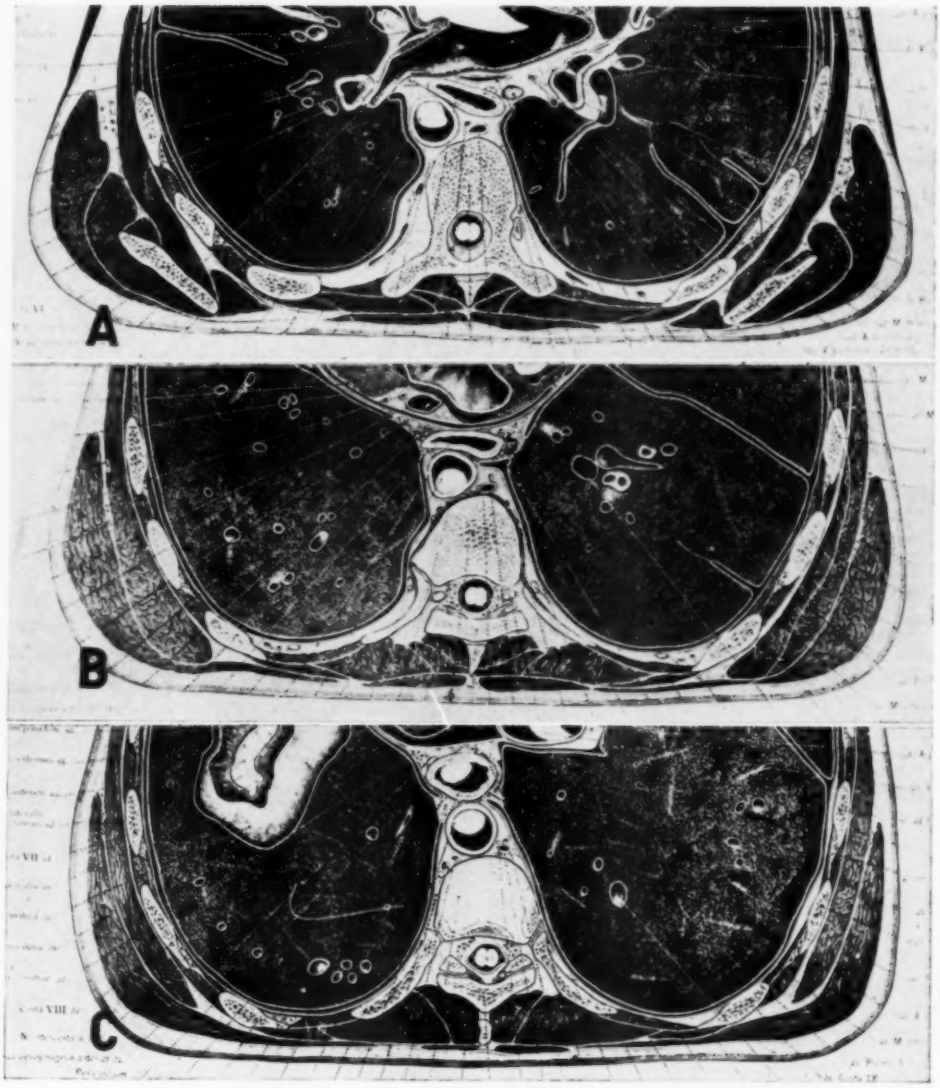

Fig. 4. Transverse sections through the thorax at the levels of the 7th body (A), the 8th body (B), and the 9th disc (C). Note the obliquity of the major portion of the right postero-mesial pleuropulmonary border in all these sections. Portions of the left posterior pleuropulmonary border have a more or less sagittal direction in some of the sections, notably at the level of the 8th thoracic body in this particular subject. (From Eycleshymer and Schoemaker: A Cross-Section Anatomy, New York, D. Appleton, & Co., Sections 25, 26 and 27.)

lines are produced by tangential projection of the pleura lying in a sagittal plane against adjacent air-containing lung. Their frequent absence on properly exposed films is due to the fact that in these cases only insufficient portions of the pleura lie in a plane parallel to the central beam.

We have reviewed some cross-section anatomical texts and received the impression that only a minority of cadavers show a sufficiently straight left posterior pleural boundary to permit its projection on the average roentgenogram. Sections at certain levels of many cadavers do, however,

show that the postero-mesial border of the lung might be so projected for a short distance, say 5 to 10 cm. It is highly probable, therefore, that the linear thoracic paraspinal shadow referred to in the original editorial is due, *not* to an azygos vein, but to part of the mesial pleural border,

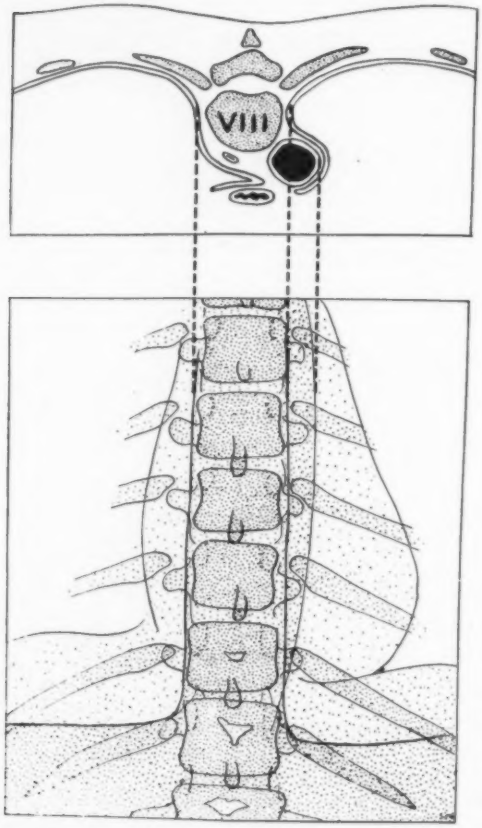

Fig. 5. Diagrammatic cross-section through the posterior mediastinum at the level of the 8th thoracic vertebra and outline of the radiographic appearance produced by the anatomical shadows discussed (Lachman: Anat. Record **83:** 526, 1942).

and hence might well be called the postero-mesial pleural line. It still remains to be determined what is its incidence in everyday radiological practice.

It is perhaps noteworthy that in the 7th edition of Cunningham's *Anatomy* (1937) there appear transverse sections of the thorax at the levels of the 6th and 8th thoracic bodies (Figs. 1001 and 997).

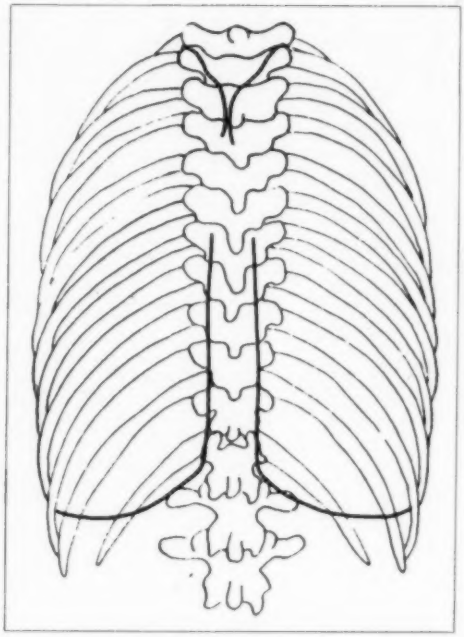

Fig. 6. Diagram of the postero-mesial borders of the lungs and pleurae, from roentgenograms of the living subject (Lachman: Anat. Record **83:** 523, 1942). Figs. 5 and 6 are reproduced through the courtesy of Professor Lachman.

In neither of these does the pleura have a sagittal direction alongside the postero-mesial portions of the lungs. In Eycleshymer's and Schoemaker's *Cross-section Anatomy* (3), however, the pleural boundary does have such a direction in some of the thoracic body sections. The following is a summary of the appearance of these posterior pleural boundaries at the levels illustrated in this excellent textbook:

Figure	Level	Plane of the Postero-Mesial Border
24	5th thoracic body	Oblique
25	7th thoracic body	Oblique
26	8th thoracic body	Sagittal
27	9th thoracic disc	Oblique
28	10th thoracic disc	Oblique
29	11th thoracic disc	Oblique
30	12th thoracic body	Line absent

Study of additional cross-section anatomical texts revealed that the pulmonary border did lie in a sagittal plane at some

level between the fifth and twelfth thoracic segments in about one-fourth of the illustrations.

CONCLUSIONS

1. On the basis of roentgen-anatomical studies by Lachman, and examination of various cross-section anatomical texts, it is concluded that the slender linear shadow, often visible on the left side and occasionally visible on the right side of the lower half of the thoracic spine, is due to axial projection of the borders of the lung and adjacent pleural coverings.

2. It is suggested that this be referred to as the postero-mesial pleural line.

REFERENCES

1. Editorial: The Linear Thoracic Paraspinal Shadow. Radiology **39:** 229, August 1942.

2. LACHMAN, ERNEST: A Comparison of the Posterior Boundaries of Lungs and Pleura as Demonstrated on the Cadaver and on the Roentgenogram of the Living. Anat. Record **83:** 521, 1942.

3. EYCLESHYMER, A. AND SCHOEMAKER, D.: A Cross-Section Anatomy. New York, D. Appleton & Co., 1911.

U. S. Naval Hospital
Oakland, Calif.

Since preparation of this manuscript, an additional contribution has been received from one of the readers of RADIOLOGY (J. F. Brailsford). This appeared to the Editor to be of such merit as to warrant publication as a separate article, which follows.

The Radiographic Postero-Medial Border of the Lung, or the Linear Thoracic Paraspinal Shadow

JAMES F. BRAILSFORD, M.D., Ph.D., F.R.C.P.

Radiological Demonstrator in Living Anatomy, University of Birmingham, Birmingham, England

UNDER THE TITLE "The Linear Thoracic Paraspinal Shadow" an editorial appearing in the August 1942 issue of RADIOLOGY (page 229) draws attention to "a slender line of demarcation which is often seen in anteroposterior or sagittal roentgenograms of the bony thorax and upper abdomen. This line lies on the left side of the lower two-thirds of the thoracic spine and sometimes continues as far down as the plane of the first two lumbar segments. The shadow is frequently an enigma to radiologists and other clinicians viewing such roentgenograms. It is not visible on all films or projections of this portion of the body but is observed with such frequency that it must be the result of variation in the course and position of a normal structure situated therein." Then follows a discussion in which it is stated that it is not bony, not due to unilateral spinal ligaments, descending aorta, or inferior vena cava, "but it might be an enlarged and elongated hemiazygos vein . . . . This editorial is written with the suggestion that this finding be referred to as the left thoracic paraspinal shadow and that its frequency be noted by various radiological observers. In this manner its true incidence may be ascertained and its apparent nature confirmed."

This radiographic line of demarcation is of great importance in the diagnosis of lesions involving the lower dorsal and upper lumbar spine. It is frequently seen on anteroposterior radiographs of the dorsolumbar area on the left side, but it is seen, though less frequently, on the right side as well. It extends upward, sometimes to the level of the 4th dorsal vertebra but only as far as the reflection of the pleura on to the diaphragm, for it marks the postero-medial border of the lung. As will be seen from the accompanying drawing of a cross-section of the body at the 9th dorsal level, the postero-medial border of the left lung, which has been more thickly outlined for emphasis, lies in a direct sagittal line for two or more inches. For the whole of this distance it is separated from the vertebral body by the pleura, fascia, and some areolar tissue. On a plane with the anterior surface of the body it is displaced laterally by the descending aorta and more anteriorly by the heart. On the right side the medial border of the lung extends partly over the anterior surface of the vertebral body and is displaced laterally by the esophagus and the heart. Anteroposterior radiographs of this area will therefore show the postero-medial boundary of the left lung as a straight line lateral to the outline of the vertebra because on the lung side of the boundary the tissue is relatively radiotransparent, whereas on the vertebral side the tissue is much more radiopaque. The descending aorta, being more opaque than the lung, will also be seen as a lineal shadow lateral to the postero-medial border of the lung, where it is superimposed over the postero-medial aspect of the lung. On the right side, on account of the shelving margin of the postero-medial aspect of the right lung, there is usually no sharp line of demarcation between it and the denser medial structures. Consequently, the border cannot be seen under these circumstances. It is for the same reason that the more anterior of the medial borders of the lung, also the anterior and posterior borders of the inferior extremities of the lung, are not shown.

A glance at Figure 1 will show at once why this line is of great diagnostic significance, for it reveals the close relationship of the medial border of the lung to the

lateral surface of the vertebral body. The postero-medial border of the lung will be displaced laterally by any expansion in the tissue medial to it whether it be pleural, interpleural, paravertebral, or vertebral. If the vertebral body is crushed, its transverse diameter will be increased and the medial border of the lung will be displaced to that extent laterally. If the fracture is

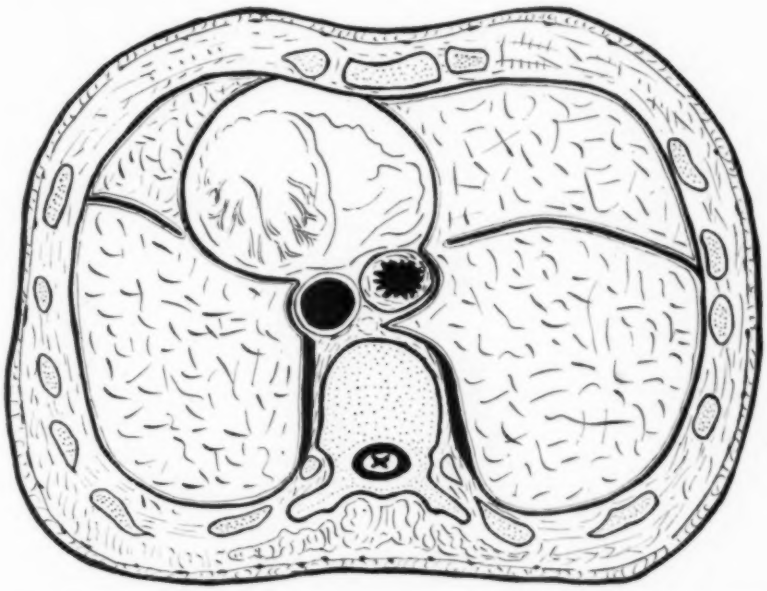

Fig. 1. Transverse section of body at level of 9th dorsal vertebra, showing relation of postero-medial surface of lung to vertebrae. On the left side this line is thickened for emphasis.

associated with a paravertebral hematoma, this will show as an added expansion and further lateral displacement of the medial border of the lung. The antero-posterior radiograph shows this as a fusiform expansion of the medial opacity, for the postero-medial border of the right lung will be similarly displaced. In a case which came to court the presence of a crush fracture of the vertebral body was disputed until the presence of a paravertebral hematoma was demonstrated to the judge on the radiograph taken immediately after the accident and its absence from radiographs taken a fortnight later.

The commonest demonstration of lateral displacement of the postero-medial border of the lung is due to the paravertebral tuberculous abscess. The displacement in these cases may be detected before any change in the bone has become apparent. The abscess may extend the whole length of the dorsal spine, usually fusiform in shape, somet mes the width of the heart shadow, for which, indeed, it has sometimes been mistaken. It may show progressive expansion from the time it is first detected. Because from the level of the reflection of the pleura onto the diaphragm there is below no contrast in the densities of the adjacent tissues, the outline of the abscess cannot be traced in the abdomen; *i.e.*, we are dependent upon the lateral displacement of the posterior-medial border of the radiotransparent lung for visualization of the abscess. Consequently, though it may have arisen from caries of one of the lumbar vertebrae, if no bone changes are yet recognizable its origin may not be apparent. Incidentally it may be stated that in the abdomen a lateral

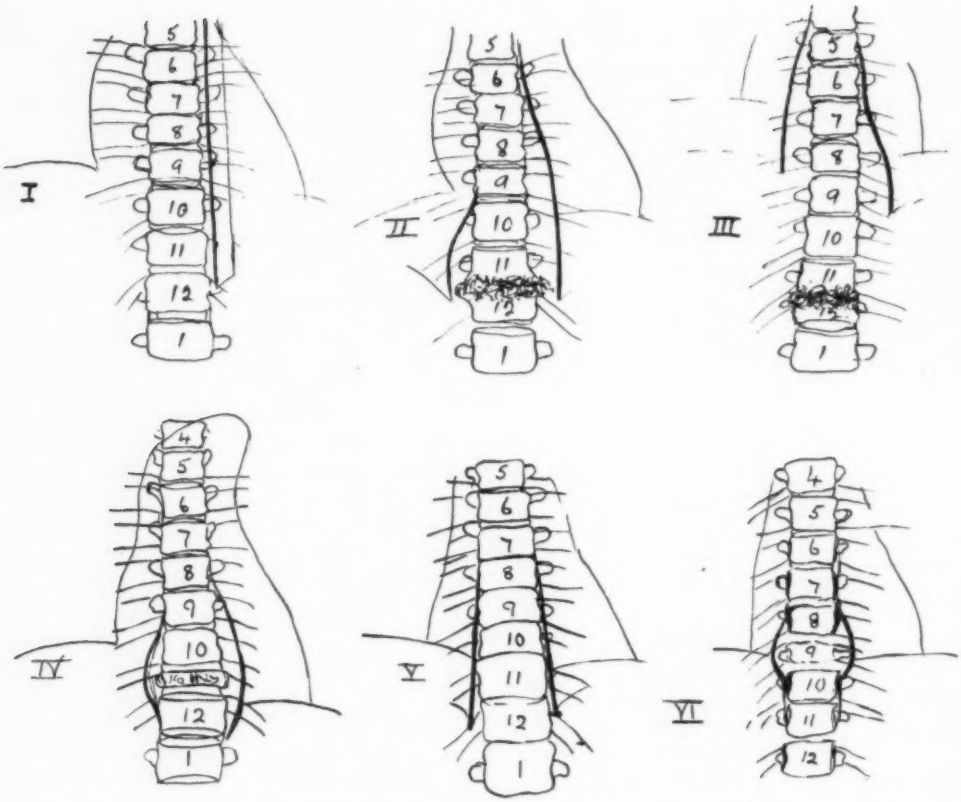

Fig. 2. Reduced tracings from roentgenograms showing the postero-medial border of the lungs in various conditions.

I. Left linear paraspinal shadow running parallel with lateral borders of the dorsal vertebrae. Still more lateral is the outline of the outer border of the descending aorta. Note that the paraspinal line ceases at the level of the inferior border of the lung.

II. Postero-medial border of the lung pushed laterally by a paravertebral abscess associated with caries of 11th and 12th dorsal vertebrae. The outline of the abscess is not indicated below the inferior border of the lung.

III. Postero-medial border of the lung pushed laterally by a paravertebral abscess associated with caries of the 11th and 12th dorsal vertebrae. Note in this case the diaphragm is elevated and the visible outline of the abscess ceases high above its origin.

IV. Postero-medial border of the lung pushed laterally by a hematoma associated with a crush fracture of the 11th dorsal body.

V. Postero-medial border of the lung shown as a bilateral paraspinal line on both sides in a case of osteochondritis of the dorsal spine.

VI. Postero-medial border of the lung pushed laterally by an abscess associated with collapse of the 9th vertebral body. Early case of vertebra plana. A month later the abscess was no longer visible.

deviation of the line of the psoas muscle may help to detect the site of an acute abscess or a chronic abscess before calcium has been deposited within it. The line of the psoas may appear to be continuous with the line of the postero-medial border of the lung.

Because of this common appearance of the dorsal tuberculous paravertebral abscess, there is a tendency to diagnose all fusiform deviations of the postero-medial borders of the lung as tuberculous in origin, but appreciation of the anatomical features I have described as giving rise to these shadows should induce further discrimination. Thus neoplasms, both primary and secondary, may cause collapse and an increase in the transverse diameter

of the diseased vertebral body and produce a lateral deviation of the postero-medial border of the lung, which will be increased, if there is proliferation of neoplastic cells or an associated hemorrhage, to such an extent that it may resemble a paravertebral abscess. It should be remembered, however, as a feature in differential diagnosis, that neoplasm appears to spare the disc even though all the vertebral body is destroyed.

Fusiform paravertebral expansions have been seen at the site of pneumococcal, typhoid, and paratyphoid abscesses. In these the destructive changes are more frequently seen in the disc, which appears to collapse, and within a few weeks the postero-medial border of the lung is again straightened out. The vertebral bodies ultimately fuse.

In the acute phase of vertebra plana the involved body is surrounded by a fusiform expansion which, within a few weeks, gradually disappears, leaving the discs apparently intact but the elements of the vertebral body compressed to a quarter or third of the normal depth.

In Paget's disease which is localized to one or more dorsal vertebral bodies the postero-medial border of the lung is deviated laterally by the expansion of the vertebral bodies.

In osteochondritis of the spine in infants and adolescents some degree of thickening of the tissues adjacent to the vertebral bodies occurs, and the medial border of both lungs may become apparent just lateral to the border of the vertebral bodies, but in this there is no localized fusiform expansion.

In one case rupture of the posterior wall of the aorta was associated with hemorrhage into the areolar tissue surrounding the vertebral bodies and an appearance simulating a paravertebral abscess was produced. Localized thickening of the pleura or localized empyema at this site also displaces the postero-medial border of the lung laterally. Any inflammatory or neoplastic proliferation within the vertebral body or the areolar tissue surrounding it may produce changes such as have been described, and it may be necessary to seek elsewhere for a clue to the identity of the organisms and cells producing the displacement of the lung.

SUMMARY

The line of demarcation formed at the flattened postero-medial border of the lung by the sharp contrast between the relative radiotransparency of the lung and the radiopacity of the vertebral tissues is of valuable diagnostic significance in cases of backache.

NOTE: The research work on anatomical subjects involved in this paper was done in the Anatomical Department of the University of Birmingham with the kind permission and the assistance of Prof. C. V. Smout.

20, Highfield Road
Edgbaston
Birmingham 15
England

The Value of Roentgen Therapy in Carcinomatous Metastases to Bone[1]

EDWARD C. KOENIG, M.D., and GORDON J. CULVER, M.D.

Buffalo General Hospital, Buffalo, N. Y.

THIS PAPER IS not being presented with the idea of offering anything new in the field of radiology. The fact that roentgen therapy has a definite place in the treatment of metastatic cancer has been recognized by radiologists for many years. We feel, however, that this branch of therapy has not received the recognition which, because of its importance, it deserves.

Failure to administer x-ray therapy to malignant bone metastases is usually due to lack of enthusiasm on the part of the surgeon or clinician who has originally seen the case. A surgeon, for example, sees a patient from whom he has removed a malignant tumor at a previous date and who now consults him complaining of pain in the back or of the sciatic type. Immediately bone metastases are suspected and x-ray examination of the lumbar spine and pelvis is requested. When the report comes back that metastases are present, the surgeon is prone to throw up his hands and classify this case as a poor surgical result and entirely hopeless. The common practice is to prescribe morphine in ever increasing doses until death brings welcome and lasting relief.

The problem, therefore, becomes one of educating the clinician and surgeon in the analgesic and reparative effects of x-rays in these cases. It is our duty as radiologists to acquaint them with certain rational therapeutic principles. To approach this task intelligently, we must first consider the pathological condition with which we are dealing and the effect this has produced on the patient.

Metastases to bone are, of course, most commonly seen in carcinoma of the breast, carcinoma of the prostate, carcinoma of the thyroid, and in hypernephroma. Undoubtedly, the most frequent metastatic tumor with which we deal is that from primary carcinoma of the breast. There is considerable controversy as to the mechanism by which malignant cells reach the skeletal system from tumors of various types. We are not here particularly concerned with this problem. The important thing is that they have reached the skeletal system and are producing symptoms. The metastases themselves may lodge either in the actual bony skeleton or in the lymphatic structures immediately adjacent to the bone. Either type of metastasis may give rise to symptoms.

Borak has classified the symptoms produced by metastatic bone tumors in two groups: first, those which involve the bone alone and produce pain which is entirely bony in origin; second, those which either involve the paraskeletal lymphatics and produce pressure on adjacent nerves or involve the bone itself in such a manner that pressure on the nerves may occur. This second group produces a neuralgic type of pain which is variable in distribution, depending on the nerve involved and on the degree of involvement. To go back to group one, in which the pain is actually of bony origin, Borak states that if the metastases are confined to the medullary or cancellous portion of the bone and the periosteal structures are not involved, pain will not be invoked. It is the distention and involvement of the periosteum which produces the pain in this type of lesion. From this, it may be seen that it is possible to have rather widespread skeletal metastases without pain, as long as there is no involvement of, or encroachment on, the periosteum. Such a theory is generally in keeping with the experience of most of us. While it is not the rule, on occa-

[1] Accepted for publication in December 1942.

sion we do see patients with no symptoms who on x-ray examination show definite evidence of skeletal involvement. In such patients symptoms do not occur until the periosteum itself becomes involved or compression of a vertebral body results in pressure on a nerve root, producing pain of the neuralgic type.

With the foregoing considerations in mind, it might be wise, as a routine, to make x-ray studies of at least the lower spine and pelvis in patients who have had malignant lesions which commonly metastasize to bone. This is particularly true in cases of carcinoma of the breast, which most commonly produces metastases in these areas of the skeletal system. On the other hand, we occasionally see in patients known to have malignant lesions symptoms which cause us to suspect metastases to the spine or pelvis, but on x-ray examination find no evidence of such metastases; yet in films of these same patients taken at a later date metastatic lesions are evident. In such cases there can be little doubt that the first symptoms encountered were the result of metastatic bone lesions. A little later we shall attempt to point out the importance of these observations in the therapy of patients with malignant growths.

At this time we must bring up a secondary pathologic process which is commonly associated with neoplasms and which is highly important in the evaluation of roentgen therapy to malignant skeletal metastases. This is the non-specific inflammatory reaction so often associated with this type of lesion, and recognized by various observers for many years. It is obvious that such concurrent reaction might readily be the causative agent of many of the symptoms associated with metastatic bone cancer.

With this background of the pathologic process and the resultant symptomatology to be expected, let us proceed to the more important question of what we can do for such a patient by means of roentgen therapy. First, we shall speak briefly of the question of cure as opposed to control in any disease. In medical practice, the ultimate aim is a complete cure of the disease process. Unfortunately, however, in a large percentage of instances, such a result cannot be attained. In cases where permanent cures cannot be effected, all therapeutic measures are directed toward the prolongation of the patient's life and alleviation of his symptoms. Applications of these principles in general medicine and surgery are well known to all of you, and we shall make no effort to enumerate them. With them in mind, we feel that the rationale of roentgen therapy for malignant bone metastases is more readily understandable.

Proceeding to the effect produced by roentgen therapy on malignant bone lesions, we shall discuss, first, that effect which is most widely known and most widely publicized—the so-called analgesic action of roentgen rays. Leddy has postulated three methods of action of x-ray in the alleviation of pain in metastatic bone lesions. These can be enumerated as follows: (1) the action on the associated non-specific inflammatory reaction; (2) the action on the malignant process itself; (3) a non-identified action on the nerves. Borak, in an extremely comprehensive study on the action of roentgen rays and their analgesic effect on bone metastases, mentions only the first two. His reason for discarding the non-specific unidentified analgesic action on the nerve itself seems rather sound. He states that exposure of non-pathologic tissues to roentgen rays results in a hyperesthesia both to touch and pain, rather than an analgesia. I think that such an observation has been made by all of us in skin reactions following roentgen therapy. Certainly there is no scientific basis for the theory that roentgen rays in any way produce hyposensitivity of nervous tissue. Borak's theory is that the reaction effected must necessarily be on a pathologic state which affects the nerve and not a primary action on the nerve itself.

The onset of analgesia from the time of starting therapy varies considerably with

the individual case. Usually we may expect diminution of symptoms to start on about the tenth day after treatment is begun. In some cases, however, complete freedom from pain may follow in as short a period as five days. Apparently the more rapid alleviation of symptoms which is sometimes noted is the result of the action of the roentgen rays on the associated nonspecific inflammatory reaction. This extreme sensitivity of chronic inflammatory processes to moderate doses of roentgen rays is well recognized. The later and more lasting analgesia results from direct action on the tumor tissue itself, with resultant shrinkage.

Many observers have commented at length on the radioresistance of skeletal metastases. Others, including Borak, have assigned an extremely high radiosensitivity to metastatic lesions in bones. Borak states that the reason for the relatively high radiosensitivity of metastatic bone lesions lies in the fact that they are doubtless comparatively weak and only slightly virulent carcinomata which, as such, can find a place to develop only in the skeletal system, which lacks all means of resisting invasion of the completely foreign tissue. Certainly, from the observations of many, it would seem that metastatic bone lesions do have at least a moderate degree of radiosensitivity, and it is not uncommon to note evidences of repair in such metastases, usually in the form of recalcification, following irradiation.

It may be well to mention at this time the lack of correlation between the patient's symptoms and general condition and the roentgen findings. This lack of correlation exists both preceding and following roentgen therapy. We cannot, therefore, use the roentgen findings as a measuring stick for the amount or duration of treatment but rather must be guided by the patient's condition. Each case is an individual problem and must be treated as such. It has been noted that patients who have metastatic bone lesions commonly do not exhibit the general debility often associated with malignant growth. This is extremely fortunate, as it allows us to deliver much higher doses of roentgen rays than we could if we were dealing with a patient in poor general condition. It seems logical, therefore, to separate patients with metastatic bone lesions into two groups. In the first group we can place those in whom the predominant feature is pain due to the metastatic lesions themselves; in the second, those in whom there are associated debility and cachexia and other general symptoms of neoplastic disease. The first is the ideal group for roentgen therapy. The value of therapy in the second group is doubtful, since in delivering sufficient dosage for relief of pain we are apt to depress an already debilitated patient to such a degree as to hasten his death; at least rather than increasing the comfort of such a patient, we add to his already existing misery.

The next problem to be considered is when therapy for metastatic bone lesions should be instituted. In a patient with previously existing cancer who shows definite radiographic changes in the skeletal system, the answer is obvious. Such a patient should be treated as soon as skeletal involvement is known, whether or not symptoms are present. Even though the patient is symptom-free, we can expect symptoms to develop at any time. If we wait for their onset before starting therapy, the malignant process already present has had a chance to progress further and produce avoidable skeletal destruction. So, as in any disease, the earlier therapy can be instituted the more definite is our advantage over the existing process.

A more complex problem is that of the patient with malignant disease who shows symptoms of bony involvement without any radiographic changes. In such a case, if no other reason for symptoms can be ascertained, we feel that roentgen therapy over the involved areas should be started on the suspicion that metastatic bone lesions may account for the pain. If alleviation of the symptoms is produced, we feel justified in continuing therapy. It

is important to make frequent checks on the skeletal system by periodic x-ray examination of the spine and pelvis. We have seen several cases in which, during the course of therapy for relief of pain, definite metastatic infiltrations developed in other areas.

The amount, duration, and site of therapy necessarily vary with each individual case. This is so because we are not attempting a permanent cure of the disease process. What we *are* attempting is to free the patient of symptoms and to prolong life. If the cure is worse than the disease, we are defeating our own purpose. On the other hand, it is important that we deliver sufficient radiation for maximum destruction of the malignant process, since the more complete the destruction the longer we can expect the patient to be symptom-free. A close check must be kept on the patient so that follow-up courses of therapy can be administered when indicated. In the meantime the general physical condition should be carefully watched and any necessary supportive measures should be used. Even under ideal conditions, the results obtained are extremely variable. In some cases we apparently do very little to alter the progress of the disease. In most instances, however, a definite improvement in the symptoms and general condition can be expected and the life expectancy can be considerably increased. In a few cases results are spectacular and the patient may carry on a normal life, with normal activity, for many years. All cases finally reach the stage where either metastases invade vital structures or where, because of increased radioresistance, therapy seems no longer to affect the metastatic areas and can be discontinued. The patient will eventually succumb to his disease but it is encouraging to note that a large number of those who have received therapy over areas of bone metastases have a relatively pain-free death as compared with the intense pain suffered by those who have not been so treated.

Thus, from therapy we may expect regression of the lesion itself, alleviation of the painful symptoms, improvement in the general condition, and prolongation of life. This is what we mean when we speak of control of the disease process. If we can return a patient to normal life for even a few months, we must feel that therapy has been of definite value. Certainly it is far superior to controlling pain with morphine, confining the patient to bed, and merely waiting for death to occur. From the standpoint of the patient's own welfare, his family, and society, roentgen therapy offers the most satisfactory method of treating metastatic bone lesions, and the results obtained certainly justify its continuation.

100 High St.
Buffalo, N. Y.

REFERENCES

1. BORAK, J.: Analgesic Effects of Roentgen Rays, with Especial Consideration of Bone Metastases of Cancer. Radiology **14:** 328–338, April 1930.

2. LEDDY, EUGENE T.: Roentgen Treatment of Metastasis to the Vertebrae and the Bones of the Pelvis from Carcinoma of the Breast. Am. J. Roentgenol. **24:** 657–672, December 1930.

3. STENSTROM, K. W., AND ERICKSEN, L. G.: Roentgen Therapy in Bone Metastasis of Carcinoma. Radiology **18:** 741–753, April 1932.

Chondro-Osteodystrophy: Morquio's Disease: Case Observed During Pregnancy[1]

PETER E. RUSSO, M.D.

Department of Radiology, State University and Crippled Children's Hospitals, Oklahoma City, Okla.

MY JUSTIFICATION for reporting a single example of chondro-osteodystrophy or Morquio's disease is that the case presents so many features of unusual interest. I was unable to find in the literature any instance in which the patient was observed during the period of pregnancy, with delivery by cesarean section. Whereas other cases have been described in children and young adults, this patient was 26 years old. The case is, I believe, the second to be reported in a Negro.

CASE REPORT

L. C. (No. 115-059), a colored female dwarf, was admitted to the University Hospitals on March 9, 1942, because of severe dyspnea, which was attributed to her pregnancy. She stated that her last menstrual period had been in August 1941, and that previous to that date the menses had been regular and normal, beginning at the age of fourteen. She had never been able to walk without some support. Both parents were dead; a sixteen-year-old brother was healthy and normal. Her step-father was responsible for her pregnancy.

The patient's body length was 36 inches and her weight 58 pounds. The head was larger than even a normal head, with eyes set far apart and the bridge of the nose depressed. The neck was not discernible and the massive lower jaw rested on the upper part of the chest. The breasts were normally developed and engorged. The abdomen was distended and an umbilical hernia was present. The fundus of the uterus seemed to occupy most of the abdominal cavity and fetal heart tones could be heard in the left lower quadrant at a rate of 140/min. All the extremities were short and stubby; the joints were enlarged and excessively flexible. The external genitalia were normally developed. Although hearing was somewhat impaired the patient answered questions fairly intelligently and could read and write. Both the Wassermann and Kahn reactions were strongly positive. The red cell count was 3,200,000; white count 9,800; serum calcium 7.3; phosphorus 5.96.

The pelvic measurements were as follows: spines 15 cm.; crests 18 cm.; trochanter 22 cm.; external conjugate 12 cm.

The x-ray findings were characteristic, in every respect, of Morquio's disease. They were as follows:

Head: The posterior clinoid process appeared thick and blunted, and the mandible massive.

Spine: The cervical portion of the spine was shortened and distorted; the thoracic curve was kyphotic, whereas the lumbar curve was lordotic

Fig. 1. The patient, a 26-year-old colored female, height 36 inches, weight 58 pounds, in approximately the seventh month of pregnancy.

All the vertebral bodies were flattened and tongue-shaped, and had an irregular outline. The intervertebral spaces were widened. The sacral vertebrae were not fused and the coccyx could not be identified. There was a spina bifida of the fifth lumbar and first sacral vertebrae.

Pelvis: There was a failure of fusion of the symphysis and the conjoined portion of the pubic and ischial rami. The acetabula were shallow, widened, and irregular in outline. The Y-shaped piece of cartilage of the acetabulum persisted. The femoral heads could not be identified. Congenital dislocation of both hips was present.

[1] Accepted for publication in January 1943.

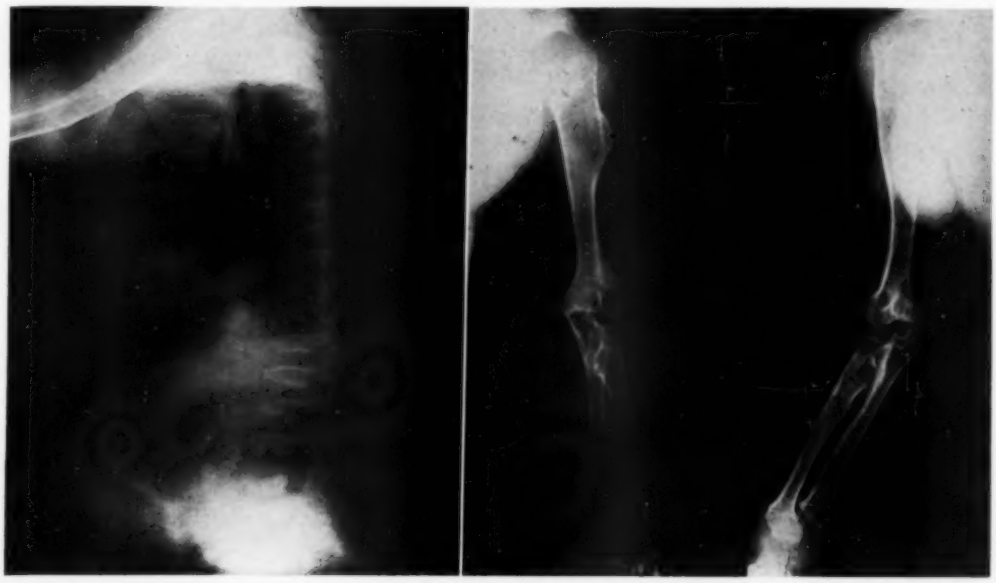

Fig. 2. The intervertebral bodies are flattened and tongue-shaped, and have an irregular outline. The intervertebral spaces are widened. There is a decided flaring of the costochondral portions of the ribs.
Fig. 3. Upper extremities, showing distortion of the long bones and fragmentation of the humeral condyle.

Ribs: There was a marked flaring of the costochondral portions of the ribs.

Lower Extremities: All of the long bones were shortened and distorted, especially at the articular surfaces, which showed various degrees of erosion, fragmentation, and non-ossification of some of the epiphyses. All joint spaces were widened. Coxa vara, genu valgum, and pes cavus deformities were present. The patella was not ossified. Of the tarsal bones, the talus and calcaneus showed the greatest degree of deformity.

Upper Extremities: The long bones of the arm and forearm showed essentially the same findings as the lower extremities. Only five of the carpal bones had ossified in each wrist.

Abdomen: A single fetus in cephalic presentation could be identified. The osseous development of the fetus was normal for seven months' gestation.

In general the bones of the patient's entire skeletal system appeared decalcified. Bone trabeculations were poorly developed and thickened. Various degrees of arrest of osseous developmental growth had occurred.

Antisyphilitic treatment—one injection weekly of mepharsen 0.04 gm.—was given until April 7, when dyspnea became so alarming that the obstetrical staff decided to perform a cesarean section. This was done and a baby girl was delivered. The mother made an uneventful recovery, but the child died after ten hours. A postmortem x-ray film was taken of the infant and a necropsy was performed.

The x-ray film of the child failed to reveal any developmental osseous abnormalities. Ossification of bones had proceded normally for an eight-month fetus.

All the organs examined at necropsy were normal. A massive atelectasis of both lungs was given as the cause of death. Several pieces of bone and cartilage examined microscopically were found to be normal. Sections of the brain stem revealed nothing remarkable.

The mother was discharged on April 23, after an uneventful recovery.

Chondro-osteodystrophy is a rare developmental disease, often familial, characterized by skeletal abnormalities with resultant dwarfism and generalized body deformities.

Morquio in 1929 (9) reported 4 cases occurring within the same family and established the disease as a clinical entity. In the same year Brailsford (2) reported a similar case. Ruggles (11) added 8 cases to the literature in 1931, giving a comprehensive description of the x-ray findings. Meyer and Brennemann (8) reported one case in 1932, in a child whom they had followed for four years. There are now approximately 30 or 40 cases on record in the literature.

Fig. 4. Lower extremities, showing genu valgum deformity, irregularity of articular surfaces, and erosion of the lateral condyle of the tibia. The patella is not ossified.

Fig. 5. Hands and feet: Only five carpal bones have ossified. There is a pes planus deformity of the feet with severe distortion, especially of the talus and calcaneus.

Our knowledge concerning the underlying cause of this disease is so meager that it has led to considerable confusion in the terminology. Some of the more common titles used to designate it are hereditary osteochondrodystrophia deformans, dyschondroplasia foetalis, eccentrochondroplasia, dysostosis multiplex, and familial rickets.

Morquio believed the disease to be hereditary and held that consanguinity and hypocalcemia played an important role. This theory, however, has not been substantiated by other authors, although most of the cases so far reported seem to follow the mendelian law. Jacobsen (7), reporting 4 cases, was able to discover 20 members of the same family afflicted in 5 generations. Shafar (12) traced the disease through 3 generations and suggests transmission through an abnormal gene. Sporadic cases also have been reported. Numerous attempts have been made by various authors to include in a common group many of the osseous dystrophies, about whose etiology very little is known. Hirsch (6) recommends Jaffe's classification, which briefly is as follows:

A. Localized types which are neither hereditary nor congenital, and are preceded by previous normal development.
   1. Single epiphysis may be involved, as in Perthes' disease.
   2. Single epiphysioid: Köhler's disease.
   3. Several epiphyses or epiphysioids may be affected.

B. Generalized types, which are usually hereditary or even congenital and appear very early in life.
   1. Dwarfism due to failure of cartilaginous growth: achondroplasia.
   2. Osteochondromata, distortion of growth usually around metaphyses: dyschondroplasia.

3. Irregular development of epiphyses and epiphysioids: eccentrochondroplasia.

Hirsch states that in eccentrochondroplasia the epiphyses and epiphysioids do not develop from a central nucleus of ossification; rather there are multiple eccentric nuclei. Further, he recognizes three stages: the *latent* stage, lasting up to the first year, during which the child develops normally; the *florid* stage, in which all the osseous abnormalities and growth disturbances make their appearance, lasting until the age of puberty, after which the *period of repair*, the third stage, ensues, although most of the deformities persist.

Kaufman's classification, quoted by Snoke (14), is somewhat simpler. Briefly stated it is as follows:

1. Hypoplastic type, in which the proliferating cartilage fails to produce enough longitudinal rows.

2. Hyperplastic type, in which the cartilage is of normal hardness but of undisciplined growth, producing epiphyses of large fungus type on normal diaphyses.

3. Malacic type, in which the proliferating cartilage is softened.

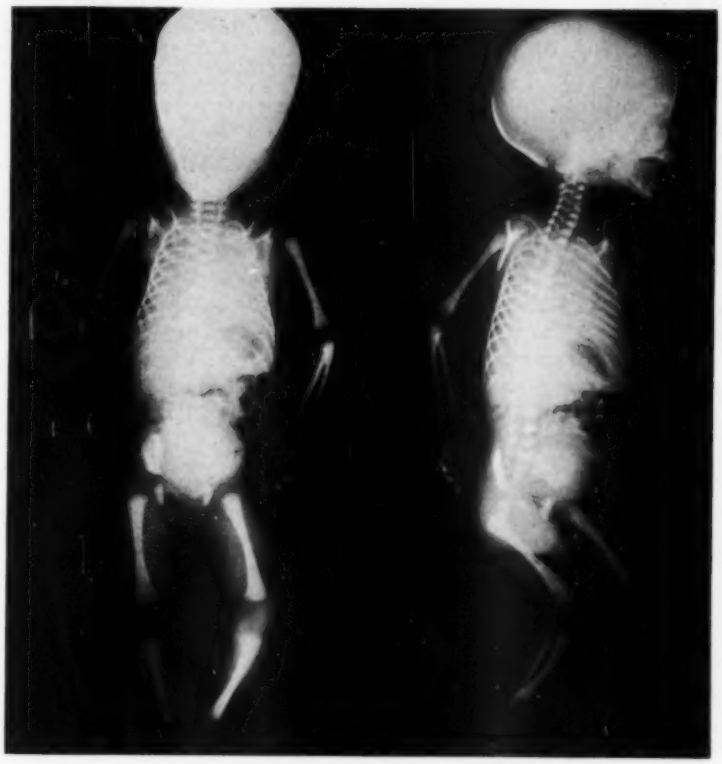

Fig. 6. Postmortem films of child, showing normal osseous development for eight months' gestation. Note air in stomach and intestines; also, massive atelectasis of both lungs. Air can be seen along the axillary borders of the lungs.

Kaufman stated that all three types of chondroplasia may be found in the same person, although one type of cartilaginous disturbance may predominate.

Ashby, Stewart and Watkin (1) had the opportunity of performing necropsies in two cases of gargoylism and reported their findings under the title of Chondro-osteodystrophy of the Hurler type. They suggest a possible relationship of Hurler's disease to a group in which faulty metabolism of lipoids is an essential feature, as

Gaucher's, Niemann-Pick's, Schüller-Christian, and Tay-Sachs disease. These authors suggest that Morquio's disease may likewise belong to this group. Other British writers (13) give lipogranulomatosis as a possible etiologic factor of Morquio's disease.

Concerning the pathology of osteochondrodystrophy very little work has been done. There is no record of a necropsy; a limited number of biopsy studies are recorded. Einhorn's (5) biopsy specimen of muscle and bone was reported as showing atrophy of periarticular and subchondral bone. Another microscopic report (3) states that the specimen revealed little other than islands of cartilage composed of irregular striated matrix of varied staining properties.

Gross findings in the disease have been adequately described and are fairly typical. These consist of dwarfism, with a normal or enlarged head sitting on the thorax, with the chin resting on the sternum. These patients appear to have no neck. The extremities are shortened and the joints are large and have a peculiar laxity and hypermotility. The pelvis is tilted forward. Coxa vara, genu valgum, and pes planus deformities exist in practically every case and are pronounced There may be associated deformities, as in Brailsford's case, with a dislocation of the vertebrae, Davis and Currier's (4) case, in which scaphocephalus produced blindness and mental symptoms, and Reed and Baylin's (10) case and the one here recorded with bilateral congenital dislocation of the hips. The mentality of these patients is usually unimpaired and the sexual organs develop normally.

The x-ray findings are as typical as the gross deformities and consist mainly of shortening and distortion of practically every bone of the skeleton. There are absence of ossification of the epiphyses and epiphysioids and delayed ossification and non-fusion of secondary centers of ossification. All joint spaces appear widened, with irregular and eroded articular surfaces. Bone architecture can be only poorly visualized. The vertebral column is always affected. The vertebral bodies are narrowed and flattened in appearance. All bones of the skeleton appear to be decalcified and the bony changes are symmetrical. Numerous areas of translucency may be seen in many of the bones, probably due to islands of cartilage which have failed to ossify.

The diagnosis may be difficult in the very early stages and treatment for rickets is frequently given. Failure of the disease to respond to vigorous vitamin therapy arouses the physician to investigate the case more thoroughly. In spite of every form of treatment, growth of the child comes to a stop or may even regress. In young adults the physical and x-ray findings can easily be identified by any one familiar with the disease. No one has reported a favorable response to any type of treatment. Vitamins, thyroid and anterior pituitary extract have been tried, and many other forms of therapy have proved unsuccessful.

CONCLUSIONS

1. A case is recorded of osteochondrodystrophy (Morquio's disease) in a 26-year-old colored female, who was observed during the latter part of pregnancy and was delivered by cesarean section.

2. The physical examination and x-ray findings conformed in most respects to previously reported cases of osteochondrodystrophy.

3. The offspring of this dwarf died ten hours after birth. Necropsy revealed no osseous abnormalities, nor was disease of any other organs found other than a bilateral massive atelectasis.

University Hospitals
Oklahoma City, Okla.

BIBLIOGRAPHY

1. ASHBY, W. R., STEWART, R. M., AND WATKIN, J. H.: Chondro-osteo-dystrophy of the Hurler Type (Gargoylism): Pathological Study. Brain **60:** 149–179, June 1937.

2. BRAILSFORD, J. F.: Chondro-osteo-dystrophy: Roentgenographic and Clinical Features of Child with Dislocation of Vertebrae. Am. J. Surg. **7:** 404–410, September 1929.

3. BRENNEMANN, J. (editor): Practice of Pediatrics. Hagerstown, Md., W. F. Prior Co., Inc., vol. IV, 1942, p. 20.

4. DAVIS, D. B., AND CURRIER, F. P.: Morquio's Disease. Report of Two Cases. J.A.M.A. **111:** 2173–2176, June 30, 1934.

5. EINHORN, N. H., MOORE, J. R., AND OSTRUM, H. W.: Osteochondrodystrophia Deformans. Am. J. Dis. Child. **61:** 776–794, April 1914.

6. HIRSCH, I. SETH: Generalized Osteochondrodystrophy: Eccentrochondroplastic Type. J. Bone & Joint Surg. **19:** 297–313, April 1937.

7. JACOBSEN, A. W.: Hereditary Osteochondrodystrophia Deformans: Family with 20 Members Affected in 5 Generations. J.A.M.A. **113:** 121–124, July 8, 1939.

8. MEYER, H. F., AND BRENNEMANN, J.: A Rare Osseous Dystrophy (Morquio). Am. J. Dis. Child. **43:** 123–135, January 1932.

9. MORQUIO: Sur une forme de dystrophie osseuse familiale. Arch. de méd. d. enf. **32:** 129–140, March 1929.

10. REED, R. J., AND BAYLIN, G. J.: Osteochondrodystrophy (Morquio). Radiology **36:** 362–366, March 1941.

11. RUGGLES, H. E.: Dwarfism Due to Disordered Epiphyseal Development. Am. J. Roentgenol. **25:** 91–94, January 1931.

12. SHAFAR, J.: Hereditary Short Digits (with Report of Two Cases of Chondro-osteodystrophy). Brit. J. Radiol. **14:** 396–402, December 1941.

13. SHANKS, S. C., KERLEY, P., AND TWINING, E. W. (editors): A Text Book of X-Ray Diagnosis. London, H. K. Lewis & Co., Ltd., 1939, Vol. 3, p. 546.

14. SNOKE, P. O.: Chondrodystrophia Fetalis: Roentgen Study of Four Cases; Two in Father and Daughter; Emphasizing Epiphyseal Changes and Variants. Am. J. Roentgenol. **29:** 31–42, January 1933.

Carcinoma of the Cervix Complicated by Complete Procidentia: Radiation Therapy[1]

ROGER A. HARVEY, M.D., and ROBERT N. RITCHIE, M.D.

Rochester, N. Y.

CARCINOMA OCCURRING in the exposed cervix of procidentia offers an unusual opportunity to observe the effects of radiation therapy in cervical cancer. Although treatment of this rare combination has been mainly surgical, radiation therapy can be used advantageously in conjunction with surgery, or to supplant surgery when the local or the general condition of the patient contraindicates operation.

LITERATURE

Seventy-eight cases of procidentia with carcinoma of the cervix are reported in the papers and related bibliographies of Andrews (1, 2), Basden (3), Brady (4), Bulman (5), Guthrie and Bache (6), Percival (7), Scheffey (8), Strauss (9), and Todd (10). An accurate analysis of these cases is difficult because in many of the published protocols much pertinent information is lacking. Some interesting data, however, can be summarized.

Carcinoma of the cervix is present in about 0.14 per cent of cases of procidentia (Judd and Graves, quoted by Strauss, and Kimbrough's discussion of the paper by Scheffey). The age variation in the reported cases is between twenty-five and eighty-six years. Although over 50 per cent of the patients presented themselves for medical examination after the age of sixty, the procidentia occurred before the fiftieth year in most of them. The extremes of duration were two days and forty years. The number of pregnancies in an individual case ranged from none to fourteen. The amount of prolapse varied from partial exposure of the cervix to complete exteriorization of the uterus; the largest presenting tumor measured 9 inches in diameter. Microscopically, the biopsy specimens revealed epidermoid carcinoma in all except one case, which proved to be sarcoma.

TABLE I: SUMMARY OF THE 11 CASES IN THE LITERATURE IN WHICH RADIATION THERAPY WAS USED

Therapeutic Agent	No. of Cases	Relief of Procidentia	"Cure" of Carcinoma	Results Not Stated
Radium	5	3	3	2
Roentgen rays	1	1	?	..
Roentgen rays and radium	1	1	1	..
Surgery and roentgen rays	1	1	..	1
Roentgen rays radium, and surgery	1	1	1	..
Surgery, radium, and roentgen rays	1	1	0	..
Radium for recurrence of carcinoma after surgery	1	..	..	1

Surgical procedures—mainly total vaginal hysterectomy, extirpation, and amputation—were the only form of treatment before the advent of radiation therapy. Forty-seven of the cases were reported after the discovery of roentgen rays and radium, and 11 of these received radiation therapy alone or in conjunction with surgery (Table I). Since, however, the reports appeared shortly after the completion of treatment, accurate survival or "cure" rates cannot be obtained for the different forms of treatment. It would seem advisable, however, to combine radiation therapy with surgery whenever possible, with the knowledge that "cure" of the carcinoma and decrease in the procidentia have occurred after irradiation alone in some instances. In view of the relatively small

[1] From the Departments of Radiology and of Obstetrics and Gynecology, and the Tumor Clinic, of the University of Rochester School of Medicine and Dentistry and the Strong Memorial Hospital, Rochester, N. Y. Accepted for publication in January 1943.

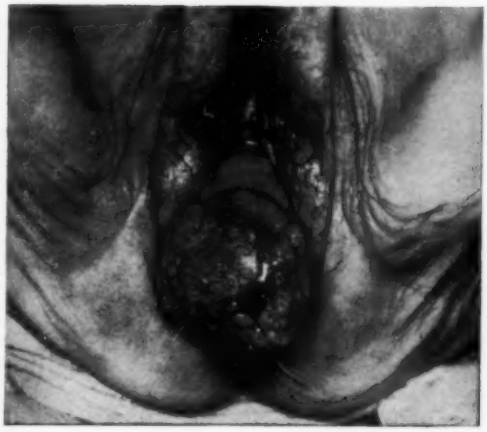

Fig. 1. Appearance of tumor-bearing area before treatment.

number of such cases in the literature, the following history is presented. The patient was an elderly woman who responded favorably to radiation, which was the only treatment given.

CASE REPORT

E. O., an 81-year-old white female, was admitted to the Gynecology Service on Nov. 4, 1941. Her history revealed one pregnancy with forceps delivery and repair of lacerations at home at the age of thirty years; an uneventful menopause at fifty years; "dropping of the womb" at sixty-nine years; intermittent vaginal bleeding since the age of seventy-six; pains in the lower abdomen and a foul uterine discharge for three weeks; severe bladder symptoms for twenty-four hours.

Examination of the perineal region showed an extensive rectocele, cystocele, and procidentia (Fig. 1). The cervix, 10 cm. in diameter, was replaced by firm, fungating tissue which bled easily and exuded foul-smelling pus on slight pressure. Above the tumor area, the uterus and vagina appeared to be normal. On inspection and palpation the cystocele was found to be folded down over the uppermost part of the outline of the uterus. There was considerable inflammation of the surfaces of the thighs adjacent to the tumor. The blood and urine were found to be normal. An electrocardiogram showed myocardial damage and auricular fibrillation. A roentgenogram of the chest revealed calcification of the aorta and aortic and mitral valves, and a large substernal thyroid shadow. A biopsy of the cervical tumor showed epidermoid carcinoma with well formed prickle cells, mitotic figures, and attempt at pearl formation (Fig. 2).

Treatment: In view of the advanced age of the patient, the severe cardiovascular changes, and the large substernal thyroid mass, as well as the unwillingness of the patient to submit to surgery, radiation therapy was used exclusively in the treatment of this case. The roentgen therapy factors were: 200 kv., 25 ma., filter 0.25 mm. Cu + 1 mm. Al + 0.41 mm. Sn, half-value layer 1.8 mm. Cu, 50 cm. target-skin distance, 23.4 r per minute. A flat lead rubber shield cut to fit around the extruded uterine site was placed against the perineum to protect the bladder, rectum, and labia during therapy. An initial dose of 100 r, measured in air, was administered directly to the exteriorized tumor, followed by 200 r the next day, and 300 r on each

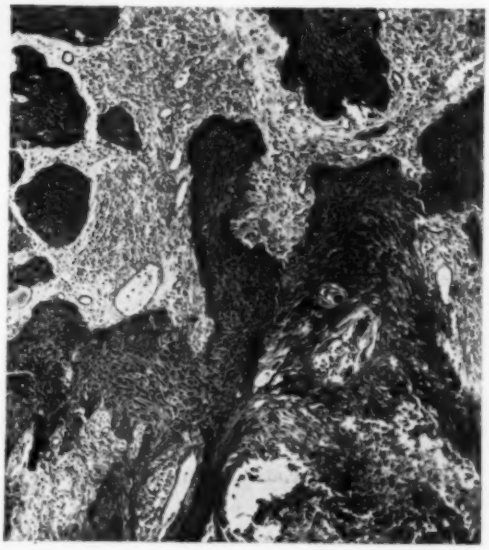

Fig. 2. Low-power microscopic view of a biopsy specimen obtained prior to treatment.

of the following eleven days. For the first three days, there was a slight increase in the size of the tumor area, then an increase in the amount of discharge, followed by a rapid shrinking of the mass. After thirteen days of treatment, during which a total of 3,600 r measured in air was given, the tumor shrank to half its original size and the previously exteriorized structures receded into the vagina (Fig. 3). The cervix rested 4 cm. above the symphysis pubis and could not be exteriorized for further examination or treatment. Additional radiation was given through a perineal port, with the factors already mentioned, and through two direct anterior and two direct posterior pelvic ports, with 200 kv., 25 ma., filter 0.5 mm. Cu + 1.0 mm. Al, half-value layer 0.9 mm. Cu, 70 cm. distance, and 26 r per minute, each port receiving three rounds of 200 r, measured in air. By this time the cervix no longer showed gross evidence of ulceration or tumor. A depth dose of 4,686 r had been delivered in twenty-six days to the mid-cervix area. Two days later, a T-tube containing 35 mg. of radium

was inserted in the cervical canal, and two colpostats, each containing 10 mg. of radium, were placed high in the lateral fornices, making a total of 55 mg. of radium. A total dose of 3,500 milligram hours of radium was given. The patient was asymptomatic and walked unaided two days later when she was discharged from the hospital.

Follow-up examination two months after treatment showed the cervix high in the vagina, free from abnormalities other than a minimal subsiding radiation reaction on the posterior lip. The parametria were free from induration. The four-month and nine-month follow-up examinations revealed slight scarring of the cervix, normal fornices, and parametria. The cervix remained high in position. Transportation difficulties prevented a one-year follow-up examination, but the patient telephoned that she had no symptoms whatever referable to the pelvis and that she was enjoying good health.[2]

Fig. 3. Regression of procidentia after administration of 3,600 r, measured in air, to exposed tumor area. Edematous labia minora are seen between the labia majora. The inferior portion of the tumor is 4 cm. above this level.

DISCUSSION

Some of the actual and theoretical problems relating to the sequence in which radium and roentgen rays should be used in the treatment of carcinoma of the cervix, whether normally situated or exteriorized, are clarified by the type of case presented. Initial exposure of a tumor of this size to radium from conventional applicators, such as T-tubes and colpostats, would result in unequal distribution of the rays in the tumor and adjacent tissues. It would also block natural drainage of the infected area by mechanical interference and edema. Insertion of radium needles into such a tumor, in an attempt to gain more uniform distribution of rays, would break through barriers already created by the host to confine the infection. The incidence of severe pelvic infection and septicemia following the initial use of radium substantiates the importance of recognizing and managing the co-existent infection. In contrast to these objections, are the advantages of the initial use of roentgen-ray therapy. Among these advantages are the application of small and controlled doses to combat the infection, which often accounts for a large portion of the tumor volume, the ease with which a uniform distribution of radiation is obtained in a large tumor area, and the resultant shrinkage of the involved area to convenient limits for the greatest intensity of radium distribution from conventional applicators.

Although the treatment of carcinoma of the normally placed cervix has gradually shifted from surgery to radiation therapy, the treatment of carcinoma of the cervix in procidentia has apparently continued to be regarded primarily as a surgical problem. This opinion has arisen from the accessibility of the involved structure to surgical procedure and lack of assurance that, even if the carcinoma is destroyed by irradiation, the procidentia will be corrected. The exact mechanism by which the procidentia is relieved or cured by irradiation is not known, but it would seem that destruction of the tumor and relief of the infection would decrease the pull of gravity upon the exposed organs. In view of the results obtained in the case recorded here, and others in the literature, it would seem wise to treat most of these patients with an initial full course of deep roentgen therapy followed by radium therapy. In younger women, and any with evidence of extension of carcinoma, roentgen therapy

[2] After acceptance of this report for publication the patient again reported for examination. At that time, fourteen months after treatment, there were no signs of recurrent tumor or procidentia.

to the exteriorized tumor should be followed by a full course of roentgen therapy to the pelvis and radium insertion for 5,000 to 6,000 milligram hours. Subsequent surgical procedures may be advisable but may depend upon the age and general condition of the patient, the degree of residual procidentia, and the outcome of repeated biopsy examinations of any areas suspicious of residual or recurrent cancer.

SUMMARY

1. Seventy-eight cases of carcinoma of the cervix complicated by procidentia collected from the literature are reviewed briefly.

2. An additional case is reported, in which roentgen and radium therapy brought about complete relief of procidentia and rapid disappearance of the carcinoma as judged by direct visual and bimanual examinations of the former tumor-bearing area. This is the second case to be recorded in which roentgen rays and radium were used exclusively in the treatment of this condition.

Strong Memorial Hospital
Rochester, N. Y.

BIBLIOGRAPHY

1. ANDREWS, H. R.: Carcinoma of the Cervix of a Prolapsed Uterus. Proc. Roy. Soc. Med. **3:** 161–164, 1909–10.

2. ANDREWS, H. R.: Carcinoma of a Prolapsed Cervix in a Woman Aged 77. Proc. Roy. Soc. Med. **16:** 109–110, 1923.

3. BASDEN, M.: Carcinoma of the Vagina Complicating a Complete Procidentia. Proc. Roy. Soc. Med. **30:** 1483–1484, October 1937.

4. BRADY, L.: Cancer of the Cervix and Vagina in a Case of Complete Procidentia. Am. J. Obst. & Gynec. **30:** 277–280, August 1935.

5. BULMAN, M. W.: Carcinoma of the Prolapsed Cervix. Clin. J. **65:** 119–121, March 1936.

6. GUTHRIE, D., AND BACHE, W.: Infrequency of Carcinoma of the Cervix with Complete Procidentia. Ann. Surg. **96:** 796–800, October 1932.

7. PERCIVAL, E.: Three Cases of Carcinoma of the Cervix with Procidentia. Am. J. Obst. & Gynec. **35:** 710–711, April 1938.

8. SCHEFFEY, L. C.: Infrequent Complications of Uterine Cancer, with Certain Clinical Observations. Am. J. Obst. & Gynec. **28:** 214–221, August 1934.

9. STRAUSS, H.: Carcinoma of the Cervix in Prolapsed Uteri. Am. J. Obst. & Gynec. **32:** 1068, December 1936.

10. TODD., T. F.: Two Cases of Carcinoma of the Cervix Complicating Procidentia Uteri. Proc. Roy. Soc. Med. **30:** 1343–1344, September 1937.

Pedunculated Tumors of the Stomach Prolapsing through the Pylorus[1]

TOBIAS B. WEINBERG, M.D., and LOUIS RAIDER, M.D., C.M.
New York, N. Y.

THOUGH NOT A common roentgenologic finding, pedunculated tumors of the stomach cannot be considered rare. Many have been demonstrated when prolapsed through the pylorus into the duodenum. Few cases however, have been described, in which the tumor was shown roentgenologically to oscillate on its pedicle between the stomach and the duodenum, as in our case.

Rigler recorded a case in which the polyp was first discovered in the duodenum. On subsequent examination it was found proximal to the pylorus and was manipulated across the pyloroduodenal junction into the duodenum. Similar cases are recorded by Schons and by Lönnerblad.

The incidence of pedunculated tumors is hard to estimate accurately. Eliason, Pendergrass, and Wright reviewed the literature on benign gastric tumors up to 1926. Of the 611 tumors in their collected series, 48 or 7.5 per cent were pedunculated. Two of these had been shown by Moore to have prolapsed into the duodenum. Eliason and his associates added 50 cases of benign gastric tumor, of which 10 were pedunculated and 5 had prolapsed through the pylorus. Pendergrass in 1930 recorded several more examples of prolapsed tumor, and McLaughlin and Conlin described still another case. If we accept the incidence of benign gastric tumors as 1.3 per cent (Eusterman and Senty) to 4.5 per cent (Minnes and Geschickter) of all gastric neoplasms, and consider that less than a tenth of these are capable of prolapse, we may place the incidence of prolapsing tumors at a fraction of 1 per cent of the total number of new growths in the stomach.

[1] From The Radiological Department, Metropolitan Hospital, New York City. Accepted for publication in December 1942.

ETIOLOGY

The etiology of pedunculated gastric tumors, like that of all new growths, is uncertain. Eliason and Wright suggest that the first step is gastric irritation, giving rise to a gastritis causing local hypertrophy of the gastric mucosa. This hypertrophy is further increased by peristalsis and the passage of food over the surface. As this process continues, the tissues become stretched and a pedicle forms. When this stalk becomes sufficiently long, it permits prolapse of the polyp into the pylorus. It is believed that alcohol is responsible for the formation in most cases.

PATHOLOGY

Pedunculated tumors are of four chief types: (1) solitary benign tumor, (2) pedunculated carcinoma, (3) a part of a multiple polyposis, (4) prolapsed mucosa.

The benign tumor may be of epithelial, mesothelial, endothelial, or of mixed origin. It may be papilloma, adenoma, myoma, myxoma, polyp, cyst, fibroma, or lipoma. The size varies from a few millimeters to 15 or more cm. in diameter. The larger tumors may weigh several pounds. The average length of the pedicle is 2 cm.

The malignant tumors are of two chief varieties. The more common form is a benign tumor which has undergone malignant change. A fungating carcinoma may, however, prolapse into the duodenum. Cases have been reported where both a carcinoma and a benign polyp were present.

Since diffuse polyposis is in itself a rare finding, the occurrence of prolapse of one of the polypi is most unusual. We have found no cases reported.

Prolapsing mucosa results from redundancy of the prepyloric mucosa which passes through the pyloric canal. Pendergrass

and Andrews reported 8 cases, of which 7 were confirmed at operation.

Possible complications are malignant change, ball-valve obstruction, intussusception, ulceration, and hemorrhage.

CLINICAL PICTURE

There is no constant or typical clinical picture. The symptoms vary with the complication which causes them. The condition occurs most commonly in males between the ages of forty and sixty, though cases have been reported in both sexes at all ages.

The chief complaint is usually epigastric distress occurring intermittently as a result of ball-valve obstruction of the pyloric canal by the polyp. This varies from a vague ache to acute crampy pain. Nausea and vomiting may accompany the attacks of pain. The taking of food or a change in position may bring relief. The patient may even have a sensation of something moving as the tumor crosses the pylorus.

In other cases the symptoms are those resulting from ulceration of the surface of the tumor. These symptoms may be indistinguishable from those of ordinary peptic ulcer. In still others, the first evidence is severe hemorrhage. A profound unexplained anemia simulating pernicious anemia may be the presenting feature.

ROENTGEN DIAGNOSIS

There are certain characteristic roentgen findings. (1) There is a filling defect which depends for its location upon the situation of the polyp at the time of examination. When the tumor is in the duodenum it may be difficult to see fluoroscopically. It will be centrally located and outlined peripherally by opaque medium. It may be possible actually to demonstrate the stalk and lobulation if the tumor is composed of many small masses. In some cases it is palpable. When present in the stomach the polyp is freely movable. Peristalsis is unimpaired. By careful manipulation, the tumor can be forced across the pyloroduodenal junction into the duodenum.

(2) Delayed emptying often results, and there may be a considerable six-hour residue.

(3) When the tumor is in the duodenum the pyloric end of the stomach appears normal.

DIFFERENTIAL DIAGNOSIS

The chief lesions with which a prolapsing gastric neoplasm may be confused are a congenital venous anomaly in the duodenal region, duodenal ulcer, pyloroduodenal adhesions, prolapsing mucosa, pancreatic pressure, hypertrophied duodenal mucosa or polyp, hypertrophied pyloric musculature, and retained food.

Congenital anomalies are more commonly seen in younger persons. They produce defects at the apex rather than the base of the cap.

In *duodenal ulcer* a central defect with a regular periphery is rarely seen.

Periduodenal adhesions may produce filling defects, but they are not so rounded and regular and the periphery of the cap is not so smooth as with a polyp.

Prolapsing mucosa causes a shortening of the lesser curvature and straightening of the rugae of the stomach.

Extrinsic pressure may produce a defect indistinguishable roentgenologically from that due to a polyp.

Hypertrophied duodenal mucosa or an actual *duodenal polyp* will be indistinguishable from a prolapsed gastric polyp. Only at operation can one be sure of the diagnosis. If, however, the polyp has been seen in the stomach, the findings suggest a gastric tumor.

Hypertrophied pyloric musculature shows narrowing of the pyloric canal. The elevations at the base of the cap are symmetrical, and there is no outlining barium.

CASE REPORT

M. C., a 75-year-old white male, was admitted for the first time on March 20, 1941, complaining of abdominal pain, anorexia, and weakness of fifteen months' duration. He had been well until December 1940, when he began to have dizzy spells and pain in the right hypochondrium coming on half an hour to an hour after meals, particularly

Fig. 1. Roentgenogram, April 3, 1941, showing normal stomach, with polyp in duodenum.
Fig. 2. Roentgenogram, Nov. 14, 1941, showing normal duodenum, with polyp in pyloric end of stomach.

after he had eaten meat, eggs, or fatty foods. During this interval he had lost 35 pounds. He had suffered intermittently from stomach trouble all his life and in his younger days was a heavy drinker. In 1897 he had gonorrhea and a chancre and in 1900 typhoid fever.

The patient appeared well developed and well nourished, apparently chronically ill. The positive findings were as follows:

Head and Neck: Telangiectasis of the nose; tongue slightly atrophic.

Lungs: Emphysematous, with occasional scattered râles.

Heart: Extrasystoles and soft systolic and diastolic murmur in the aortic area.

Abdomen: The liver was enlarged, firm and nodular. The right lobe, as far as the parasternal line, extended two fingers below the costal margin, then enlarged to a rounded mass 4 or 5 fingers below the costal margin. The left lobe was coarsely nodular and extended 1 finger below the costal margin. Dilated veins were seen over the lower chest and lateral abdominal walls.

Laboratory data, except for a white cell count of 13,500, were not significant.

Roentgen examination, performed April 3, 1941, showed the stomach to be normal in size and position with no evidence of intrinsic disease. There appeared to be extrinsic pressure along the lesser curvature. Within the lumen of the duodenal bulb was a persistent rounded filling defect around the periphery of which the opaque medium passed freely into apparently normal second and third portions of the duodenum (Fig. 1). At five hours, there was no gastric residue. The head of the opaque column was in the sigmoid and the tail in the cecum. A diagnosis was made of polyp in the duodenum and extrinsic pressure on the stomach by the liver. A second examination was not done, as the patient left the hospital.

The patient was readmitted to the Medical Service on Nov. 7, 1941, with complaints similar to those on his original admission. He had become progressively worse and had lost 15 pounds since his discharge. Physical examination was essentially the same except for the further weight loss and an icteric tinge to the skin.

Laboratory findings now showed definite evidence of liver damage. Urine and blood counts were essentially unchanged. The erythrocyte sedimentation rate was 67 mm. in an hour; urea nitrogen 10.0; creatinin 0.9; sugar 95; icteric index 12.5; direct delayed Van den Bergh reaction; cephalin precipitation 3 plus; total cholesterol 86, free 44; phosphorus 3.9; phosphatase 9.2; total protein 7.63; fibrinogen 0.33; albumin 2.9; globulin 4.4; Takata Ara test weakly positive.

Roentgen examination now revealed a circumscribed irregular defect in the region of the lesser curvature of the pyloric end of the stomach near the sphincter (Fig. 2). Despite this defect, peristalsis was normal along the entire curvature. The duodenal bulb filled normally. There was no five-hour residue. A diagnosis was made of a mobile pedunculated polyp of the pylorus capable of prolapsing into the duodenum. This was confirmed two days later when, on re-examination, the polyp was found in the duodenum, and a mucosal study (Fig. 3) showed a stalk and lobulation.

The patient became progressively worse and died on Feb. 8, 1942.

At autopsy the stomach was found to be small

Fig. 3. Mucosal study, Nov. 24, 1941, showing stalk and lobulation of polyp.

Fig. 4. Autopsy specimen showing polyp originating in stomach and overlying the duodenum.

and congested. At the pyloric ring was a pedunculated polyp attached to the lesser curvature. The peduncle was about 7 mm. long and the polyp itself measured 1.3 × 0.9 cm. (Fig. 4). Its base was about 4 mm. removed from the duodenum so that when tilted down its head protruded into the duodenum. There was no evidence of induration in the polyp itself or in the surrounding areas. The rest of the gastro-intestinal tract was normal.

The stalk of the polyp was formed of loose fibrous tissue, the polyp itself consisting of enlarged, dilated, and saccular glands which were lined by a simple layer of epithelium showing many goblet cells with some increase in secretion of mucus. The basal membrane was intact and the appearance of the polyp was entirely benign.

Diagnosis: Benign polyp of the pyloric region of the stomach.

The liver was enlarged and full of nodules, which proved microscopically to be multiple primary carcinoma of the intrahepatic biliary ducts.

SUMMARY

A case of pedunculated prolapsing tumor of the pylorus is described, and a review of the literature is presented, with a discussion of etiology, pathology, symptoms, roentgen findings, and differential diagnosis.

67 Park Ave.
New York, N. Y.

BIBLIOGRAPHY

1. ELIASON, E. L., PENDERGRASS, E. P., AND WRIGHT, V. W. M.: Roentgen-Ray Diagnosis of Pedunculated Growths and Gastric Mucosa Prolapsing through the Pylorus. Am. J. Roentgenol. **15:** 295–322, April 1926.

2. ELIASON, E. L., AND WRIGHT, V. W. M.: Benign Tumors of the Stomach. Surg., Gynec. & Obst. **41:** 461–472, October 1925.

3. EUSTERMAN, G. B., AND SENTY, C. G.: Benign Tumors of the Stomach. Surg., Gynec. & Obst. **34:** 5–15, January 1922.

4. LÖNNERBLAD, L.: Zwei Falle von Magen-invagination. Acta radiol. **14:** 82–94, 1933.

5. MCLAUGHLIN, C. W., JR., AND CONLIN, F.: Pedunculated Gastric Tumors. Am. J. Surg. **46:** 250–258, November 1939.

6. MINNES, J. F., AND GESCHICKTER, C. F.: Benign Tumors of the Stomach. Am. J. Cancer **28:** 136–149, September 1936.

7. MOORE, A. B.: Roentgenologic Study of Benign Tumors of the Stomach. Am. J. Roentgenol. **11:** 61–66, January 1924.

8. PENDERGRASS, E. P.: Prolapse of Pedunculated Tumors and Gastric Mucosa through Pylorus into Duodenum: Roentgenologic Diagnoses. J. A. M. A. **94:** 317–321, Feb. 1, 1930.

9. PENDERGRASS, E. P., AND ANDREWS, J. R.: Prolapsing Lesions of the Gastric Mucosa. Am. J. Roentgenol. **34:** 337–350, September 1935.

10. RIGLER, L. G.: Roentgenologic Observation on Benign Tumors of the Stomach, with Report of 15 Cases. Am. J. Surg. **8:** 144–150, January 1930.

11. RIGLER, L. G.: Roentgen Observation of Benign Tumor of the Stomach Prolapsing through Pylorus: Case Report. Am. J. Roentgenol. **20:** 529–531, December 1928.

12. SCHONS, E.: Papilloma of Duodenum: Report of a Case. Am. J. Roentgenol. **35:** 208–211, February 1936.

Effect of Roentgen Irradiation on the Hormone Content and Secretion of the Adrenal Medulla[1]

W. RAAB, M.D., and A. B. SOULE, Jr., M.D.

Burlington, Vt.

THE EFFECT OF roentgen rays upon the adrenal glands is of practical interest in view of the various indications for roentgen irradiation of the adrenal region. Beneficial effects of such irradiation have been reported in thromboangiitis obliterans and peripheral arteriosclerosis of the extremities (Philips and Tunick; Zimmern, Chavany, and Brunet; Delherm and Beau; Langeron and Desplats; Gilbert and Babaiantz; Hippe and Hähle; Raab, *a*), angina pectoris (Hutton; Raab, *b;* Schittenhelm; Hadorn; Lippross), hypertensive crises (Langeron and Desplats), Cushing's syndrome (Cushing; Jamin; Dattner), and essential hypertension (Zimmern and Cottenot; Sergent and Cottenot; Quadrone; Hutton). In the last of this group, however, the results are controversial, a number of investigators having failed to observe any therapeutic effect on the increased blood pressure (Groedel; Weinstein; Levy-Dorn and Weinstein; Desjardins and Marquis; Seyfried and Wachner; Raab, *c*). Also, the effects reported by some authors in diabetes mellitus (Dresel; Beumer; Hutton) appear dubious and could not be confirmed (Desjardins; Raab, *c*). It is to be borne in mind, however, that Hutton combined irradiation of the adrenal region with irradiation of the hypophysis, as did also the workers recording favorable results in Cushing's syndrome.

A considerable amount of experimental work has been carried out in regard to the effect of roentgen rays on the adrenal glands, dealing chiefly with morphological changes. The literature on this subject was reviewed in 1937 by Engelstad and Torgersen. These Norwegian investigators observed in rabbits treated with single doses of 2,200 to 2,500 r an initial hyperemia of the adrenal cortex beginning within ten hours after treatment and receding during the first two to three days. Pronounced degenerative changes were found from the sixth day on, reaching a maximum within three months after treatment. Doses of 1,000 r did not suffice to produce this effect (Engelstad). No significant structural changes were seen in the medulla, a finding in accord with observations of Frey, Cottenot, Holfelder and Peiper, and Celotti. Other workers (v. Decastello, Tsuzuki, Strauss, Gabriel, Rogers and Martin) reported hemorrhages and atrophic changes within the medulla after the administration of large doses.

Experimental observations regarding the functional response of the adrenal glands to roentgen irradiation are scarce. Hesse examined irradiated adrenal glands of guinea-pigs by Folin's colorimetric method. Doses of 700 to 800 *e* were followed by a diminution of the adrenalin content, reaching 50 per cent in some instances. Smaller doses (120 to 250 *e*) had a weaker effect or none at all. The animals were killed within eight days after treatment.

A diminution of the adrenalin content of the adrenal glands eight days after application of 1 H.E.D. was also observed by a colorimetric method by David and Hirsch. Weaker doses (1/4 H.E.D.), on the other hand, were believed by these authors to increase the production of adrenalin, although it is not clear whether the increased amounts of adrenalin found within the glandular tissue were due to actually increased production or to a decreased secretory elimination and resulting intraglandular storage.

[1] From the Departments of Biochemistry and Radiology, University of Vermont, Medical School, Burlington, Vt. Accepted for publication in December 1942.

No significant functional changes were observed during several months by Martin, Rogers, and Fisher, and by Rogers and Martin, in dogs from which one adrenal gland was removed while the remaining one was exposed to irradiation causing fibrotic changes (dosage 6 to 8 times 3 1/2 human erythema doses).

Zunz and La Barre assumed an increased secretion of adrenalin within a few hours following irradiation of the glands of dogs (100 to 300 r) from the intensification of the biological effects of the blood taken directly from the adrenal vein upon blood pressure, the tonus of the spleen capsule and of the isolated intestine.

Certain changes of the blood-sugar curve after irradiation of the adrenal region in man were interpreted by Seyfried and Wachner as being due to either stimulation or depression of adrenal secretion, according to dosage. Repeated small doses (200 r each) seemed to increase the blood sugar level; single larger doses (600 r) had the opposite effect.

More general statements in regard to a specific depression of irritability of the sympathetic nervous system, of which the adrenal medulla is a part, by roentgen rays, have been made by Bienvenu and Fournier, Celotti, Langer, Zimmern and Chailley-Bert, Desjardins, Holmes, Schittenhelm, Gilbert, Gouin and Bienvenu, and others. These last authors speak of a "functional radiotherapy of the sympathetic system" and emphasize the fact that medium doses are less likely to alter a normally functioning system than to restore normal conditions in a sympathetic system which is "out of equilibrium."

This conception seems to be supported by observations made by one of us (Raab, *d*), who found an abnormal adrenal hormonal discharge into the blood regularly present within a few minutes after exercise in patients with angina pectoris. Roentgen irradiation of the adrenal region (necessarily including a part of the supplying nervous structures) was followed by a disappearance of this abnormal discharge and by restoration of essentially normal conditions, also, in regard to the subjective symptoms and the electrocardiogram (Raab, *b*). It was concluded that in these cases a depressing effect was exerted by radiation therapy upon the abnormal secretory excitability of the adrenals. No significant structural changes were found in the adrenal glands of three patients who had been treated at intervals of a few weeks to thirteen months before death.

EXPERIMENTAL STUDIES

The following experiments were carried out on white male rats. A modification of Shaw's method for the colorimetric determination of "adrenalin" in blood and tissues (Raab, *e*) was used. The values obtained with this method do not refer to adrenalin alone, however, but include other adrenalin-like substances with a catechol nucleus which are present in the adrenal medulla, and ascorbic acid (Raab, *f*). Adrenal cortical steroids do not participate, contrary to previous interpretations (Raab, *e*). The term "AC" (adrenal catechols) will henceforth be used to designate the total colorimetric readings. The so-called "specific ratio" permits certain conclusions in regard to the qualitative composition of the total AC material. The greater its denominator, the larger is the proportion of adrenalin proper.

For examination of the adrenal glands both organs were pooled and analyzed together. In a number of experiments the heart was also examined for its hormone content, since in previous experiments it had been found that the heart muscle has an outstanding tendency to accumulate both injected and spontaneously secreted adrenal catechols, *e.g.*, after physical exercise, and thus can serve as an indicator of the secretory intensity of the adrenal medulla (Raab, *g*). Furthermore, the myocardial AC concentration appeared of interest in view of the pathogenic role of abnormally intense AC discharges after exercise in angina pectoris and of their abolition by x-ray therapy of the adrenal glands (Raab, *d*).

For irradiation the rats were anesthe-

TABLE I: EFFECTS OF IRRADIATION ON HORMONE CONTENT OF ADRENALS AND HEART

	No. of Rats	Body Weight (gm.)	Weight of Organs (per cent of body weight)	AC* in Organs (color units per gram of tissue)	Denominator of Specific Ratio†
First Group (Summer)					
Adrenals (averages)		162	0.0124	187,766	1.37
Control series	16	(115–192)	(0.0100–0.0147)	(134,856–288,936)	(1.00–1.83)
Sixty-eight hours after 100 r	8	264	0.0109	185,035	1.14
		(223–284)	(0.0085–0.0163)	(93,369–289,230)	(1.05–1.24)
Sixty-eight hours after 1,000 r	9	187	0.0158	113,595	1.33
		(174–204)	(0.0132–0.0192)	(52,181–182,745)	(1.11–1.56)
Second Group (Fall)					
Adrenals (averages)					
Control series	13	244	0.0109	314,843	1.13
		(218–268)	(0.0077–0.0137)	(229,375–434,400)	(1.00–1.28)
Sixty to 68 days after 100 r	9	246	0.0113	379,706	1.18
		(195–301)	(0.0094–0.0215)	(190,857–530,435)	(1.07–1.30)
Sixty to 68 days after 1,000 r	7	215	0.0109	277,436	1.43
		(187–231)	(0.0093–0.0120)	(230,188–360,000)	(1.22–1.67)
Hearts (averages)					
Controls	12	247	0.29	1,244	1.10
		(195–281)	(0.26–0.31)	(863–1,529)	(0.90–1.27)
Sixty to 68 days after 100 r	8	255	0.28	1,099	1.01
		(214–311)	(0.26–0.31)	(885–1,464)	(0.95–1.12)
Sixty to 68 days after 1,000 r	6	201	0.32	918	1.07
		(170–225)	(0.28–0.38)	(868–1,028)	(1.00–1.17)

* The term AC means adrenal catechols (not adreno-cortical compounds as in previous publications).
† The specific ratio is determined by the qualitative composition of the AC material (see page 57).
The figures in parentheses indicate the range of variations within each group of experiments.

tized with nembutal and 100 or 1,000 r were applied in single doses with 200 kv. p., 20 ma., Cu 0.5 mm., Al 2.0 mm.; the cone focused on the back over the adrenal area.

In the first group of experiments (Table I) only the adrenal glands were examined. This group consists of untreated controls and of rats killed sixty-eight hours after irradiation.

One hundred r did not cause any change of the average total AC concentration per weight unit of adrenal tissue. Only the concentration of adrenalin proper seemed to be slightly diminished, as concluded from the specific ratio. The slight difference in the weight of the adrenals (in relation to body weight) is the less significant in this series, as the experimental animals were considerably heavier than the controls. No such large weight discrepancy existed between the controls and the animals treated with 1,000 r. In the latter the adrenal glands were 27 per cent heavier and the AC per weight unit was decreased 39.5 per cent.

The second group of experiments (Table I) revealed seasonal changes in AC concentration which had been expected from previous experiences. It included a control group of rats which had been irradiated sixty to sixty-eight days previously. In this group were included two series of rats which were forced to swim in cool water 15 minutes, whereupon they were killed for examination of the heart. Since physical exercise of this kind had previously been found (Raab, *c*) to be followed immediately by a reduction of the weight and AC concentration of the adrenal glands, analyses of the adrenal glands were carried out only in those irradiated rats which had not been used for exercise experiments.

Sixty to sixty-eight days after the application of doses of 100 r or 1,000 r the weight of the glands was unchanged; the average AC concentration was increased 20 per cent in the animals treated with 100 r and decreased 12 per cent in those treated with 1,000 r. In the latter the concentration of adrenalin proper appeared slightly increased.

The average AC concentration of the hearts after exercise was diminished in both series: −12 per cent in the animals treated with 100 r and −26 per cent in those treated with 1,000 r.

Six per cent of the rats treated with 100 r and 38 per cent of those treated with 1,000 r died spontaneously within the sixty days following irradiation. They were not examined because the organs could not be obtained fresh for analysis. The rats which had received 1,000 r showed a slight loss of hair in the circumscribed irradiated area on the back.

COMMENT

The early increase in weight of the adrenal glands, within sixty-eight hours, after a dose of 1,000 r is to be explained by the initial hyperemia which was observed by various investigators. The presence of extra amounts of blood in the glands accounts undoubtedly in part for the diminution of the AC concentration in these heavily irradiated animals. When this factor is considered in the calculation, a real AC diminution of only about 10 per cent will result.

The 20 per cent increase of the AC concentration, sixty to sixty-eight days after irradiation, in the rats treated with 100 r seems more significant and may possibly indicate a depression of secretory irritability leading to storage of hormonal material within the glands. Structural damage to the glands cannot be assumed with this weak dosage according to observations of other workers. Such damaging effects appear probable, however, after the heavy dose of 1,000 r and to these the slight diminution of AC concentration in the glands (−12 per cent) may be attributable.

A decrease of the AC secretion under the stimulus of physical exercise in comparison to normal conditions appeared evident sixty to sixty-eight days after irradiation with both 100 and 1,000 r, but was greater with the latter dose. The smaller dose, which is approximately comparable to the 600 r given over each gland in the routine treatment of angina pectoris, seems to depress the secretory activity alone, in analogy to the findings in human blood after exercise, while the heavy dose appears to impair both hormone production and secretion.

The changes of the specific ratio in all groups were too slight to permit any definite conclusions in regard to qualitative alterations of the adrenal hormone content except, perhaps, a greater prevalence of adrenalin proper in the bulk of AC in the adrenal glands of rats treated with 1,000 r, sixty to sixty-eight days after irradiation.

TABLE II: DEVIATIONS FROM CONTROLS IN IRRADIATED ANIMALS

Dose of X-Rays and Interval between Irradiation and Examination	Adrenal Glands		Heart after Exercise
	Deviation of Weight	Deviation of AC	Deviation of AC
100 r			
68 hours	−12%*	−1%	....
60–68 days	+4%	+20%	−12%
1,000 r			
68 hours	+27%	−40%	....
61–68 days	±0%	−12%	−26%

* This apparent decrease in weight is not conclusive, due to a considerable difference in the average body weight of the controls and the irradiated animals in this particular series.

CONCLUSIONS

Roentgen irradiation of the adrenal region of white rats with 100 r and 1,000 r did not cause any significant change in the medullary hormone content of the glands within sixty-eight hours.

After sixty to sixty-eight days, however, there were indications of a diminished secretory activity following a dose of 100 r; a similar decrease combined with a slightly diminished hormone production was observed after irradiation with 1,000 r.

These findings are consistent with previous observations of the hormone level in the blood of patients with angina pectoris, whose abnormally intense adrenal discharges were abolished within several weeks by irradiation of the adrenal region.

College of Medicine
University of Vermont
Burlington, Vermont

BIBLIOGRAPHY

BEUMER: Über die Röntgenbestrahlung der Nebennieren bei Diabetes. Deutsch. med. Wchnschr. **47**: 369, 1921.

BIENVENU AND FOURNIER: Quoted by Schittenhelm.

CELOTTI, A.: Ricerche istologiche sul comporta-

mento delle surrenali e in particolar modo della loro innervazione di fronte all'azione dei raggi X. Boll. d. Soc. ital. di biol. sper. **6:** 998–1000, 1931.

COTTENOT, P. H.: Action des rayons X sur les glandes surrénales; recherches cliniques et expérimentales. Paris, Vigot Frères, 1913.

CUSHING, H.: "Dyspituitarism": Twenty Years Later, with Special Consideration of Pituitary Adenomas. Arch. Int. Med. **51:** 487–557, 1933.

DATTNER, B.: Zwei Fälle von Cushing'schem Adenom. Wien. klin. Wchnschr. **48:** 809, 1935.

DAVID, O., AND HIRSCH, A.: Experimentelle Untersuchungen über den Adrenalingehalt der Nebennieren nach Röntgenbestrahlung. Klin. Wchnschr. **2:** 790, 1923.

V. DECASTELLO, A.: Über Veränderungen an den Nebennieren nach Röntgenbestrahlung. Wien. klin. Wchnschr. **25:** 759, 1912.

DELHERM AND BEAU: La radiothérapie des syndromes organovégétatifs. Paris, Masson, 1936.

DESJARDINS, A. U.: Effect of Irradiation on the Suprarenal Gland. Am. J. Roentgenol. **19:** 453–461, 1928.

DESJARDINS, A. U., AND MARQUIS, W. J.: Blood Count and Blood Pressure in High Voltage Therapy. Radiology **2:** 252–259, 1924.

DRESEL, H.: Über Herabsetzung des Blut- und Harnzuckers durch Röntgenbestrahlung der Nebennieren beim Diabetiker. Deutsch. med. Wchnschr. **46:** 1246, 1920.

EISLER, F., AND HIRSCH, M.: Über die Einwirkung der Röntgenstrahlen auf die Nebennieren. Verhandl. d. deutsch. Röntgen-Gesellsch. **9:** 104–105, 1913.

ENGELSTAD, R. B.: Histologische Veränderungen in den Nebennieren nach Röntgenbestrahlung, Strahlentherapie **56:** 58–68, 1936.

ENGELSTAD, R. B., AND TORGERSEN, O.: Experimental Investigations on the Effects of Roentgen Rays on the Suprarenal Glands in Rabbits. Acta radiol. **18:** 671–687, 1937.

FREY, H.: Experimentelle Untersuchungen über die Röntgensensibilität der Nebennieren. Acta radiol. **9:** 23–53, 1928.

GABRIEL, G.: Die Beeinflussung von Tierorganen durch Röntgenbestrahlung. Strahlentherapie **22:** 107–124, 1926.

GILBERT, R.: Über die Röntgentherapie der Angina pectoris. Strahlentherapie, **57:** 203–223, 1936.

GILBERT, R., AND BABAIANTZ, L.: Die Röntgentherapie bei Gefässstörungen der Extremitäten. Strahlentherapie **53:** 455–472, 1935.

GOUIN, J., BIENVENU, A., ET AL.: Transmission par injection de sang, de caractères sanguines acquis par la radiothérapie sympathique. Bull. et mém. Soc. de radiol. méd. de France **17:** 286–288, 1929.

GROEDEL, F. M.: Wird der Blutdruck durch Röntgenbestrahlung der Nebennieren beeinflusst? Strahlentherapie **2:** 224–226, 1913.

HADORN, W.: Untersuchungen des Herzens im hypoglykämischen Schock. Arch. f. Kreislaufforsch. **2:** 70–156, 1937.

HESSE: Inaugural Dissertation, Freiburg, 1923.

HIPPE, H., AND HÄHLE, K.: Beiträge zur Röntgentherapie des Sympathicus. Klin. Wchnschr. **15:** 1596–1597, 1936.

HOLFELDER, H., AND PEIPER, H.: Die Strahlenempfindlichkeit der Nebennieren und Wege zur Verhütung von Nebennierenschädigungen in der Röntgen-Tiefentherapie. Strahlentherapie **15:** 1–17, 1923.

HOLMES, G. W.: Discussion of paper by Samuel and Bowie. Am. J. Roentgenol. **27:** 870–876, 1932.

HUTTON, J. H.: Radiotherapeutic Treatment of Hypertension and Diabetes. Radiology **24:** 330–341, 1935.

JAMIN, F.: Die hypophysäre Plethora. Munich, J. F. Lehmann, 1935.

LANGER, H.: Der Effekt der Röntgentherapie auf das vegetative Nervensystem. Strahlentherapie **53:** 492–522, 1935.

LANGERON, L., AND DESPLATS: Troubles vasomoteurs des extrémités et radiothérapie surrénale et sympathique. Presse méd. **41:** 189–190, 1933. La radiothérapie fonctionelle sympathique et glandulaire. Paris, Doin, 1933.

LEVY-DORN, M., AND WEINSTEIN, S.: Zum Verhalten des Blutdruckes nach Röntgenbestrahlung. Fortschr. a. d. Geb. d. Röntgenstrahlen **28:** 175–178, 1921.

LIPPROSS, O.: Zur Pathologie und Therapie der Angina pectoris. München. med. Wchnschr. **27:** 727, 1941.

MARTIN, CH. L., ROGERS, F. T., AND FISHER, N. F.: Effect of Roentgen Rays on the Adrenal Gland. Am. J. Roentgenol. **12:** 466–471, 1924.

PHILIPS, H. B., AND TUNICK, I. S.: Roentgen-Ray Therapy of Thrombo-Angiitis Obliterans: Preliminary Report. J. A. M. A. **84:** 1469–1472, 1925.

QUADRONE, C.: Contributo clinico alla radioterapia delle ghiandole surrenali in alcuni stati ipertensivi. Riforma med. **1:** 178–183, 1913.

RAAB, W.: (*a*) Zur Röntgentherapie der Dysbasia angiosclerotica. Med. Klin. **35:** 569–572, 1939. (*b*) Roentgen Treatment of the Adrenal Glands in Angina Pectoris (100 cases). Ann. Int. Med. **14:** 688–710, 1940. (*c*) Unpublished data. (*d*) Abnormal Suprarenal Discharges in Angina Pectoris and Their Control by X-Ray Therapy. J. Clin. Endocrinol. **1:** 977–982, 1941. (*e*) Presence and Chemical Determination of Adreno-Cortical ("AC") Compounds in the Blood. Endocrinology **28:** 325–336, February 1941. (*f*) Corrected Evaluation of Results Obtained with Shaw's Colorimetric "Adrenalin" Method. Endocrinology **32:** 226–228, 1943. (*g*) Chemical Determinations of the Adreno-Cortical (AC) Hormones in the Heart Muscle of the Rat. Endocrinology **29:** 564–573, 1941.

ROGERS, F. T., AND MARTIN, C. L.: Effects of X-Rays on the Adrenal Gland. Am. J. Physiol. **93:** 219–226, 1930.

SCHITTENHELM, A.: Aus dem Indikationsgebiet der Strahlenbehandlung von Hypophyse, Schilddrüse und Nebennieren. Strahlentherapie **66:** 373–427, 1939.

SERGENT, E., AND COTTENOT, P.: L'irradiation des glandes surrénales dans la thérapeutique de l'hypertension artérielle. Bull. et mém. Soc. méd. des hôp. de Paris **37:** 385–392, 1914.

SEYFRIED, H., AND WACHNER, G.: Röntgentherapie der Nebennieren und Adrenalinwirkung. Wien. klin. Wchnschr. **52:** 619–621, 1939.

SHAW, F. H.: Estimation of Adrenaline. Biochem. J. **32:** 19–25, 1938.

STRAUSS, O.: Zum Verhalten des Blutdruckes nach Röntgenbestrahlung. Fortschr. a. d. Geb. d. Röntgenstrahlen **28:** 467–472, 1921–22.

TSUZUKI, M.: Experimental Studies on the Biological Action of Hard Roentgen Rays. Am. J. Roentgenol. **16:** 134–150, August 1926.

WEINSTEIN, S.: Blutdruck nach Röntgenbestrahlung München. med. Wchnschr. **68:** 471, 1921.

ZIMMERN, A., AND CHAILLEY-BERT: Quoted by Gilbert.

ZIMMERN, A., CHAVANY, J. A., AND BRUNET, R.: La radiothérapie des gangrènes sèches par irradiation de la région surrénale. Presse méd. **39:** 1061–1066, 1931.

ZIMMERN, A., AND COTTENOT, P.: Modifications de la pression artérielle chez l'homme par l'exposition aux rayons X de la région surrénale. Compt. rend. Soc. de biol. **72:** 676–679, 1912.

ZUNZ, E., AND LA BARRE: Action des rayons X sur l'adrénalinémie. Compt. rend. Soc. de biol. **96:** 126–128, 1927.

Preliminary Notes on the Effect of Roentgen Rays on Sulfonamides in Vitro[1]

IVAN C. C. TCHAPEROFF, M.D., D.M.R. and E.

Formerly Assistant Radiologist to the Vancouver General Hospital, Vancouver, B. C.

IN THE PAST FEW years much attention has been given to the treatment of infective lesions with sulfonamides and roentgen rays. It is now a generally accepted fact that while either method of treatment may, in certain cases, be equally beneficial, the two should not be used together (1, 2, 3). Clinical observations have indicated that a combination of adequate sulfonamide treatment, internally, with roentgen therapy, coincidentally, fails to check the inflammatory process and may even have a definitely deleterious effect. This observation does not appear to apply to the use of small quantities of sulfonamides to clean chronically infected growths which are receiving large doses of irradiation.

The poor results obtained by the combined use of roentgen rays and sulfonamides would appear contradictory. As no experimental work on the subject could be found, it was decided to investigate it.

It has been recognized for many years that radiation is capable of bringing about chemical changes in certain compounds, though, as a matter of fact, these changes are few in number. Clark (4) quotes the work of Stenstrom and Lohmann (5), who have shown that certain amino acids are altered by radiation and that tyrosine is changed in the phenol group. One of the best known chemical changes produced by the roentgen rays, though it has little application today, is the decolorization of methylene blue (6 and 7). In the case of this chemical, it has been shown that in an aqueous solution there is an optimum concentration at which the change is most marked, but it is retarded or even prevented by a very small concentration of acetone. Morse and Fricke (8), who made this latter observation, offer no explanation for it. In the case of fuchsin, it has been shown that roentgen rays initiate a primary change which takes time to develop (9); that is to say, if the fuchsin in a solution is measured twenty-four hours after irradiation, more destruction of the dye will be noted than immediately following irradiation. These investigations were made in an attempt to find a chemical reaction similar to the physical reaction displayed by the Sabouraud-Noire pastilles, but of greater accuracy, as a measure of radiation dosage. For various reasons, among them the difficulty of knowing how much radiation was absorbed by the chemical container and the fact that no simple compound could be found which responded equally well over a wide band of kilovoltages, the methods were never adopted to any extent, and with the advent of satisfactory methods of measuring x-ray intensity by ionization, interest in such compounds lapsed. The earlier work on these indicators showed that the changes produced in tyrosine were proportional to the dosage as measured in roentgens, while those produced in methylene blue were not. If, however, the log of the percentage of methylene blue remaining unchanged, as measured spectrophotometrically, is plotted against the time of exposure, a straight line is obtained, indicating an exponential change.

The articles of Fildes (10) and the recent work of Rubbo and Gillespie (11) on the mode of action of sulfonamides *in vitro* have done much to suggest a rational explanation for the action of these drugs. It would appear that if the sulfonamides were broken down by irradiation—a point not investigated by the above workers, since it was outside the scope of their

[1] Accepted for publication in December 1942.

TABLE I: EFFECT OF IRRADIATION OF SULFONAMIDES

Drug	Present before Irradiation	Amount after Irradiation as Measured by Marshall Method	Amount Destroyed (Percentage of Quantity Originally Present)
Sulfanilamide	1 mg. in 10 c.c. water	None*	100%
Sulfanilamide plus trichloracetic acid	1 mg. in 10 c.c. water	None*	100%
Sulfanilamide	20 mg. in 10 c.c. water	18.2 mg.	9%
Sulfanilamide	2 mg. in 10 c.c. water	None*	100%
Sulfanilamide	10 mg. in 10 c.c. water	3.8 mg.	60%
Sulfathiazole	1 mg. in 10 c.c. water	None*	100%
Sulfathiazole	20 mg. in 10 c.c. water	18.2 mg.	9%

* Some small quantity of the drug could be present. The Marshall test will not read accurately below 0.4 mg. in 10 c.c., but when 2 mg. were irradiated in 20 c.c. of water the quantity remaining was still not readable, indicating less than 0.2 mg. in 10 c.c.

investigations—an unfavorable reaction might occur from the break-down products of the irradiated drug aiding the growth of the bacteria or injuring the normal tissues.

The sulfonamides used in the experiments to be recorded here were stock solutions of pure sulfanilamide and sulfathiazole as used in the Marshall test. The solutions were placed in well corked glass test tubes so filled as to leave no air space. The test tubes were then placed within the cupola of a 200-kv., 4-valve. Victor X-ray Corporation deep therapy unit (Type KX-3) so that they received unfiltered radiation.

The results of the experiments are shown in Table I. It should be noted that the two drugs were broken down in exactly similar proportions, and that, as the concentration diminishes, the percentage of change increases. The experiments are unfortunately too few[2] to postulate absolutely the existence of an optimum peak concentration such as was shown to exist in the case of methylene blue. It was also noted that the solutions in the test tubes from being water-like underwent a noticeable change, so that the fluid had a slightly yellow, smoky appearance. No figures as to dosage are given because of the difficulty of making the calculations in the cupola. These will be published at a later date. The time of irradiation was three hours.

Graphs drawn to show the percentage of chemical destroyed in solutions of different strength (not reproduced here) would indicate that the quantity of chemical undergoing change is influenced by the percentage concentration of the drug and that in weaker solutions the latter is more easily destroyed. When the amount of the sulfonamide destroyed is plotted against the original amount in solution, there is a peak at the 10-mg. level, indicating that an optimum concentration appears to exist for this reaction. When equal volumes (20 c.c.) of 0.01 per cent and 0.001 per cent solution of sulfanilamide were irradiated, the result was similar to that given in Table I for the different concentrations. When equal volumes and concentrations of sulfanilamide and sulfathiazole were treated, the remaining quantities were equal as measured by Marshall's test. All the measurements were made according to the Marshall test, using known standard solutions and keeping separate unirradiated solutions as a control.

The conclusion which can be drawn from these experiments is that sulfanilamide and sulfathiazole are equally altered by roentgen irradiation. The radiation would appear to affect the compounds by altering the NH_2 group. The compound produced is incapable of being coupled with the naphthyl ethylene diamine as in the usual diazotization and prevents the development of the pink color of the Marshall test.

This evidence that sulfonamides can be broken down by irradiation *in vitro*, leads to the belief that a similar effect may occur *in vivo*, probably with a much smaller dose of radiation. It is possible that the

[2] The work was interrupted by the author's entrance into military service.

breakdown of even a small fraction of sulfonamide is sufficient to neutralize the beneficial action of a much larger quantity of the unaltered drug. Rubbo and Gillespie showed that one part of *p*-aminobenzoic acid was capable of neutralizing 26,000 parts of sulfonamide.

The exact nature of the compounds produced after irradiation of the sulfonamides has not been elucidated.[3] They are, however, under investigation and may prove to be compounds favorable to growth of bacteria. It appears that radiation interferes with the 1:4 disubstituted benzene ring structure of the compound, and may thus have an antisulfonamide quality. Sulfonamides, being 1:4 derivatives of benzene, are compounds structurally related to p-aminobenzoic acid, which, as a result of the work of Rubbo and Gillespie (11), is now recognized as a bacterial growth factor.

Kelly and Dowell (1) point out that little is known and nothing has been proved as to the exact reason for the favorable therapeutic action of x-rays in infections. It has long been believed that the effect of radiation is on the lymphocytic infiltration around an inflammatory focus, the lymphocytes being destroyed and freeing protective substances which neutralize bacterial and other toxic products. When the cells are destroyed, these protective substances become immediately available for defensive purposes. Investigations along the lines of the experiments of Rubbo and Gillespie are being carried out, using irradiated sulfonamides and irradiated *p*-aminobenzoic acid.[4] It is hoped to show that irradiation of these substances alters their growth-producing effect on bacteria. This will indicate that the effect of irradiation on an inflammatory tissue is a direct chemical one. Such findings will explain more easily the favorable prophylactic results obtained by irradiation in gas gangrene produced by *Cl. oedematiens*, as instanced by Kelly and Dowell. It will also explain the action of irradiation on infective lesions. It is now a recognized fact that the beneficial effect of roentgen rays is reduced in the presence of loculated pus. This is also true of the action of sulfonamides, MacLeod (1940) having shown that they are easily neutralized by collections of pus so that a bacteriostatic action is no longer present.

The proof of a bacteriostatic action of roentgen rays will postulate a new theory as to the effect of irradiation on inflammatory tissues and would indicate that the effect is a chemical action which directly inhibits the growth factor.

NOTE: I wish to express my thanks to Dr. B. J. Harrison, Director of the X-ray Department of the Vancouver General Hospital, for his encouragement and for facilities to carry out the experiments in the department, and to Dr. H. H. Pitts, Director of the Pathological Department, for help in carrying out the estimations of sulfonamide solutions.

4726 Belmont Ave.
Vancouver, B. C., Canada

[3] It is known that, under strong light, sulfonamides in the presence of nascent oxygen decompose into phenol, nitrogen gas, and mineral acid according to the formula

$$C_6H_5N_2X + HOH \longrightarrow C_6H_5OH + N_2 + HX.$$

[4] The author has also broken down p-aminobenzoic acid with irradiation.

REFERENCES

1. KELLY, J. F., AND DOWELL, D. A.: Roentgen Treatment of Infections. Chicago, Year Book Publishers, Inc., 1942.
2. KELLY, J. F., AND DOWELL, D. A.: Roentgen Treatment of Acute Infections with Modified Mobile X-Ray Apparatus. U. S. Nav. M. Bull. **37:** 600–610, October 1939.
3. KELLY, J. F.: Sulfanilamide. Victor News, General Electric X-Ray Corporation, December 1939.
4. CLARK, G. L.: Applied X-Rays. New York, McGraw-Hill Book Co., Ed. 2, 1932.
5. STENSTROM, W., AND LOHMANN, A.: Effect of Roentgen Radiation on Solutions of Tyrosine and Cystine. J. Biol. Chem. **79:** 673–678, October 1928.
6. STENSTROM, W., AND LOHMANN, A.: Color Changes Produced by Roentgen Rays in Some Aqueous Solutions. Radiology **16:** 322–327, March 1931.
7. CLARK, G. L., PICKETT, L. W., AND JOHNSON, E. D.: New Studies on Chemical Effects of X-Rays. Radiology **15:** 245–261, August 1930.
8. FRICKE, H., AND MORSE, S.: Chemical Action of Roentgen Rays on Dilute Ferrosulphate Solutions as Measure of Dose. Am. J. Roentgenol. **18:** 430–432, November 1927.
9. CLARK, G. L., AND FITCH, K. R.: Chemical Effects of X-Rays upon Some Aromatic Colors and Dyes. Radiology **17:** 285–293, August 1931.
10. FILDES, P.: Rational Approach to Research in Chemotherapy. Lancet **1:** 955–957, May 25, 1940.
11. RUBBO, S. D., AND GILLESPIE, J. M.: Mode of Action of Sulphonamides in Vitro. Lancet **1:** 36–38, Jan. 10, 1942.

Clinico-Pathological Conference[1]

PETER BENT BRIGHAM HOSPITAL, BOSTON, MASS.

M. C. Sosman, M.D., S. A. Levine, M.D., Orville Bailey, M.D.

M. M., a 52-year-old single Irish domestic, entered the hospital in March 1941 because of an illness which began with a severe "cold in the chest," which she contracted six months previously. After subsidence of her acute respiratory symptoms she became aware of a constant pain in the back between the scapulae. This was usually a dull gnawing pain but at times it became severe, sharp, and boring in character. It radiated to both shoulders and around both sides of the chest. The pain often awakened her at night. She had found that aspirin gave partial relief from it. There was no relation of the pain to activity or to any other factor. Soon thereafter she became persistently hoarse and noticed lack of appetite and a sense of weakness.

The family history was non-contributory. Prior to her present complaints the patient had had no illnesses of consequence. There was no history of any venereal disease. She attended the outpatient clinic of another hospital in December 1940. Her physical examination at that time was remarkable only for a paralyzed left vocal cord. A roentgenogram of the chest showed the upper mediastinal shadow markedly increased in size, measuring 10 cm. in transverse diameter. There was a rounded area of soft tissue density within the curve of the aortic arch, which could not be separated from the aorta. No normal aortic shadow could be seen through this mass. The esophagus was displaced to the right and posteriorly and its lumen was compressed. The trachea was also displaced to the right. The heart showed only moderate left ventricular enlargement. The lung fields were clear. The findings were considered consistent with aneurysmal dilatation of the aortic arch. An electrocardiogram showed only a left axis deviation and a low E.M.F. There was no anemia. The blood Hinton and Kahn reactions were negative on two testings. No treatment was prescribed.

In January 1941 the patient began to have a very irritative frequent cough, productive of only a small amount of clear mucoid sputum. Back pain, anorexia, and weakness became so severe that she lost some 20 pounds (from her usual weight of 130) and for two weeks before admission to the hospital she was forced to remain in bed because of the weakness. One week before entry she noticed that her face was swollen, and she became short of breath upon talking. On the day of admission she coughed up a tablespoonful of blood-stained sputum. In addition to the above, the patient stated that she had experienced infrequent attacks of palpitation for the preceding six months. She had noticed no exertional dyspnea, precordial or substernal pain, or swelling of the legs. She had been using only one pillow at night.

Physical Examination: Temperature 99°. Pulse 110. Respirations 25. Blood pressure in the right arm 120/80; in the left arm 130/80. The patient was pale and tired-looking, with a frequent brassy cough and obvious livid swelling of the face and neck. The voice was hoarse, with a rasping quality. The eyes showed equal pupils with active response to light, no exophthalmos, and normal fundi. Laryngoscopy confirmed the complete paralysis of the left vocal cord. There were distended superficial veins over the neck, upper arms, and anterior thorax. In the latter veins the direction of blood flow was downward toward the inferior vena caval system. All fingers and toes showed clubbing. There was slight, generalized, non-tender enlargement of lymph nodes. The trachea was displaced to the right but there was no

[1] Case record prepared by Mark S. Donovan, M.D., Senior Assistant Resident in Roentgenology.

tug. The left chest showed diminished excursion, moderate dullness to percussion, diminished tactile fremitus, and decreased breath sounds. The right chest was clear. No râles were heard over either lung. Retromanubrial dullness was increased to right and left. The heart was not enlarged to percussion, the sounds were distant and indistinct, and there was no thrill. No definite murmurs were heard. Examination of the abdomen was negative, the liver not being palpable. There was no edema of legs or sacrum. No neurologic abnormalities were found aside from the vocal cord paralysis.

Laboratory Data: Blood Hinton and Wassermann tests were negative. Urine showed albumin 1+. The red blood cell count was 4.27 million; hemoglobin, 9.2 gm., hematocrit 37; sedimentation rate 52 mm. in 1 hour (Wintrobe method); white cell count from 10,500 to 20,600, with neutrophils 76 to 93 per cent. The blood smear showed no abnormal forms of leukocytes. Feces were negative for occult blood. An electrocardiogram (3 leads) was within normal limits in all respects. The circulation time, using decholin, was 20 seconds (normal, 10–12 seconds). Venous pressure: right arm 340 mm., left arm 320 mm., right femoral 90 mm., all measured in water. A lumbar puncture showed normal fluid and dynamics and gave negative gold sol and negative Hinton and Wassermann reactions.

Roentgenographic Data: On admission, roentgenograms showed a dense, indistinctly outlined mass filling the upper anterior portion of the left chest and displacing the heart, trachea, and esophagus to the right (Fig. 1). There was a small amount of aerated lung at the left apex above the mass. The left lower lobe exhibited coarse mottling and there was slight congestion of the right lung. The paravertebral line on the left and the descending aorta could not be made out. The left main bronchus appeared considerably narrowed. It was felt that the findings were consonant with a neoplasm, possibly primary in the left upper lobe.

Lipiodol bronchograms, made two days later, showed narrowing of the trachea just above the carina, and complete obstruction of the left main bronchus at a point 2 cm. from the carina (Fig. 2). The left chest had become completely opaque (Fig. 3), a marked change since the original examination. Again it was felt that a primary carcinoma of the left main bronchus was probably responsible for the findings. Films of the skull, pelvis, and long bones showed nothing abnormal.

Hospital Course: The patient's status remained unchanged during the first week in the hospital. X-ray treatments were then begun, 260 r being given daily to the left upper chest, with 200 kv., 50 cm. target-skin distance, 0.5 mm. Cu plus 1 mm. Al filtration, and a circular portal 10 cm. in diameter. Six treatments were given. After the second treatment, the patient had her first attack of choking coughing, and cyanosis. This began with stertorous, irregular and difficult breathing, leading rapidly to deep cyanosis. At first the pulse was rapid and thready, but then became imperceptible and no heart sounds could be heard. At this time the patient became unconscious and incontinent of urine. After about 60 seconds her pulse returned, weak, rapid, and irregular; she regained consciousness, sweated profusely, and with the aid of oxygen soon returned to her usual self. She averaged one or two such episodes daily during the remaining week of her life. It was not possible to obtain an electrocardiogram during an attack. Independent of the attacks, however, two episodes of auricular fibrillation (apical rate about 140) were recorded. These lasted about four hours each.

Because of a fairly rapidly progressing anemia, the hemoglobin falling from 9.1 to 6.8 gm. in eight days, two transfusions of 300 c.c. each were given, without reaction. On the day of death, breathing became labored, rapid, and shallow, and the right chest was filled with rhonchi The temperature, which had previously not been above 100.6°, rose to 104°. A chest film

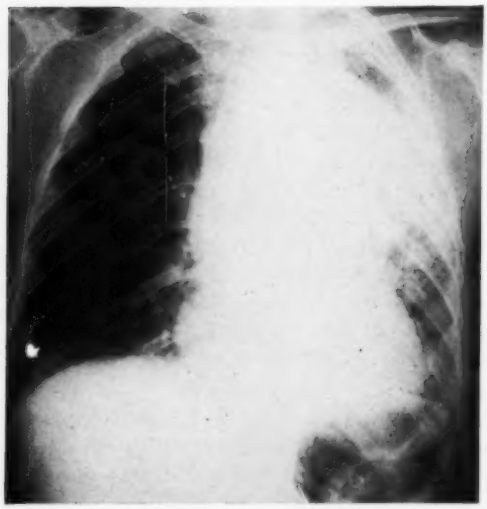

Fig. 1. Admission roentgenogram showing mass filling upper anterior portion of left chest, displacing heart, trachea, and esophagus to the right.

showed great diminution of the right lung space, apparently due to further displacement of the heart and mediastinum to the right. The left chest remained completely opaque. Respirations gradually failed and the patient died in coma, the heart beating for several seconds after breathing ceased.

DISCUSSION OF ROENTGENOGRAMS

Dr. Sosman: At the time when the films were interpreted (Figs. 1, 2, and 3), we did not know about the previous x-ray examination in another hospital (Fig. 4), but I am not sure that it would have made any difference in our deductions. Our problem was to explain the upper mediastinal syndrome (swollen, cyanotic facies, distended veins in face and neck, increased venous pressure in upper extremities), as well as the paralysis of one vocal cord, the hemoptysis, and the loss of weight. In many cases an accurate pathological and even etiological diagnosis can be made from the x-ray examination alone. In other cases one must have the history or the physical findings or some of the laboratory results before an accurate differential diagnosis can be made. But in too many cases, with all of the facts obtainable, we are still unable to offer more than a guess, based on a series of probabilities, as to the exact process underlying or causing the gross changes which we delineate so easily in our x-ray examination. Such was the situation in this patient. The gross shadow obscuring the upper anterior portion of the left lung did not have the distinct outlines of a benign tumor of the lung or mediastinum, nor was it localized enough to suggest a lung abscess or an empyema. The long prodromal symptoms and the mediastinal symptoms, as well as the laboratory findings, were very much against a pneumonia, which it could have been from the film alone, except for the displacement of trachea and esophagus toward the opposite side. Aneurysm of the aorta was considered, chiefly because of the pain between the shoulders and the paralysis of the vocal cord. Aneurysms can and do press upon the left bronchus at times, a fact which was known to Francis Williams forty years ago, but in my experience and according to

Fig. 2. Lipiodol bronchogram showing narrowing of the trachea just above the carina and complete obstruction of the left main bronchus.

Williams' original descriptions[2] they are more apt to cause only partial compression of the bronchus with a ball-valve type of obstruction resulting in obstructive emphysema usually localized to the left upper lobe.

The various mediastinal tumors were next considered, but the x-ray findings were thought to be incompatible with any

Fig. 3. Lipiodol bronchogram showing complete opacity of left chest. This picture was taken two days after that reproduced in Fig. 1.

of them except possibly Hodgkin's disease with invasion of the lung and compression of the bronchus, or tuberculous mediastinitis, also with secondary intrabronchial and intrapulmonary extension. The rapid change in the x-ray appearance in two days (Figs. 1 and 3) could be explained by a partial obstruction of the left main bronchus becoming complete, as it was shown to be in Fig. 2. The only remaining reasonable alternative under consideration was a primary carcinoma of the bronchus. This would best account for the progressive illness of six months' duration, for the cough, the hemoptysis, the loss of weight, and, if we assumed metastatic nodes in the mediastinum, for the upper mediastinal syndrome, the paralysis of the vocal cord, and the clubbed fingers. There is no better way, short of a biopsy, to rule out Hodgkin's disease than a therapeutic trial of x-ray, and on that basis x-ray treatments were instituted, the clinicians concurring.

[2] Williams, Francis H.: The Roentgen Rays in Medicine and Surgery. New York, Macmillan Co., 3d ed., 1903, pp. 200 and 349.

Fig. 4. Film made in another hospital eleven weeks before admission to Peter Bent Brigham Hospital. The findings were considered consistent with aneurysmal dilatation of the aortic arch.

I might add parenthetically that if we had realized that the left main bronchus was completely obstructed (which we doubted before lipiodol injection because of the absence of atelectasis), we would have been much more cautious about the instillation of the medium. The filling of the trachea and bronchi was unusually easy, probably due to the vocal cord paralysis. The peculiar funnel-shaped obstruction of the left main bronchus was quickly demonstrated, but when the lipiodol began to fill the right bronchus, the patient experienced marked respiratory difficulty. Obviously this was the only remaining airway and the patient was almost drowned by the lipiodol. After obtaining the spot film (Fig. 2) postural drainage was instituted and the patient promptly cleared her airways and recovered consciousness.

DISCUSSION OF CLINICAL ASPECTS

Dr. Levine: From a clinical point of view this case starts off as a straightforward example of aortic aneurysm. Pain between the scapulae not related to effort, then paralysis of the left vocal cord, cough, and finally evidence of superior vena caval obstruction are the main features. The diagnosis then becomes doubtful because of certain other findings, and bronchogenic cancer appears more likely. Of first importance are the negative Wassermann and Hinton tests. When we were doing only the Wassermann test we found that 20 to 25 per cent of cases of syphilitic aortitis, proved at autopsy, gave a negative reaction of the blood. With the more sensitive Hinton test, the figure was reduced to 10 per cent. There still remain then a small number of cases in which the diagnosis of syphilitic disease of the aorta will be correct in the face of a negative blood test. Secondly, the roentgenologist, whose opinion we greatly respect, leaned in favor of a diagnosis of neoplasm of the bronchus, lungs, and mediastinal nodes rather than aneurysm. Clubbing of the fingers occurs in both conditions, somewhat more frequently with tumor than with aneurysm. Likewise, displacement of the trachea and compression of a bronchus occur in either condition.

My own conclusion is that cancer of the left bronchus is the most likely diagnosis, mainly because of the negative serologic tests and the roentgenologist's report.

Clinical Diagnosis: Bronchogenic carcinoma of left lung.

Roentgen Diagnosis: Bronchogenic carcinoma of left lung.

Pathological Diagnosis: Syphilitic aneurysm of aortic arch with compression and erosion of esophagus and left main bronchus.

PATHOLOGY

Dr. Bailey: The mass in the chest proved to be an aneurysm of the aorta, 24 cm. in circumference, involving the aorta from a point 5 cm. above the aortic valve to a point just below the level of the bifurcation of the trachea. The trachea and esophagus were displaced about 3.5 cm. to the right of their usual position. The aneurysm encroached upon the posterior mediastinum. As a result, the anterior wall of the esophagus was necrotic at the level of the bifurcation of the trachea. The wall of the aneurysm was very thin at this point and covered by necrotic material, but there was no evidence of hemorrhage into the gastro-intestinal tract. There was a similar area of pressure necrosis in the left primary bronchus 4 cm. from the carina. Here, however, a probe could easily be passed from the aneurysm into the bronchial lumen. The bronchi distal to this point contained blood-tinged fluid. The entire left lung was consolidated, and from its cut surface large amounts of sanguineous fluid were expressed. There was slight longitudinal wrinkling of the intima in the thoracic portion of the aorta in the parts not involved by the aneurysm. The superior vena cava was compressed by the aneurysm and was thrombosed.

On histologic examination the thoracic aorta, both in the aneurysm and in other parts, showed extensive vascularization of the media. There was a rather marked proliferative endarteritis of the adventitial arteries and arterioles. The vasa vasorum were surrounded by collars composed mostly of plasma cells with a few lymphocytes. We feel that the histology is so characteristic of syphilis that we can definitely consider the aneurysm as syphilitic in origin, in spite of the negative serological tests and our failure to demonstrate spirochetes in Levaditi preparations. In addition to these findings, there was an acute inflammatory process in the wall of the aorta, characterized by polymorphonuclear leukocytic infiltration. Sections of the left lung presented evidence of old and recent hemorrhage.

Our interpretation of the sequence of events is that the aneurysm encroached slowly upon the left main bronchus. In consequence, the wall became necrotic and pyogenic bacteria gained access to the aneurysm wall, setting up an acute in-

flammatory reaction. As the pressure persisted, a slow leakage of blood took place into the bronchus. The blood was aspirated into the lung over a considerable period. As the process continued, a point was finally reached at which the ever-increasing filling of the lung tissues, combined with the progressive distortion of mediastinal structures, resulted in death.

POSTMORTEM DISCUSSION OF ROENTGENOGRAMS

Dr. Sosman: This was a very interesting and intriguing case and I hope our x-ray reports did not mislead the clinicians too much. The wise clinician is the one who knows when to disregard the x-ray reports or the laboratory findings in favor of judgment based on long experience. Our interest was focused chiefly on the complete obstruction of the left main bronchus without the usual associated atelectasis and upon the rapid changes which occurred in the left lung in only a few days. Bronchial obstruction is nearly always associated with atelectasis and a consequent shift of the mediastinum toward the involved side, except in the following conditions:

1. When the obstructed lung is full of tumor and unable to collapse.
2. When the lung is full of infection behind the obstruction, with either consolidation or "drowning" of the lung by retained secretions.
3. When there is a large amount of pleural fluid on the obstructed side, compensating for the collapse of the lung.
4. When the obstructed lung is full of hemorrhage, as was the case in this patient.

The rapid progress of the disease seemed more suggestive of a malignant tumor than of aneurysm, and we tried x-ray therapy, hoping we were dealing with a sensitive tumor. As it turned out, this did no harm and I do not think anything we could have done would have saved the patient's life. If we had correlated the very rapid development of anemia with the rapidly developing opacification of the lung, we would still have considered hemorrhage from an intrabronchial tumor more probable than hemorrhage from a ruptured aneurysm.

I might sum up my excuses for missing the diagnosis by a series of arithmetically progressive improbabilities:

(*a*) Aortic aneurysms are becoming increasingly rare (at least in New England).

(*b*) They are less frequent in single Irish domestics than in other patients of southern European or African origin.

(*c*) Complete stenosis of a primary bronchus is quite uncommon in aortic aneurysms.

(*d*) Complete bronchostenosis almost always results in atelectasis, whereas this patient's obstructed lung occupied a larger volume of the chest than a normal lung would have occupied.

This is one case where the roentgenologist who saw the patient first had the best opportunity to make the correct diagnosis and did so (Fig. 4). Much more frequently the reverse is true.

IN RETROSPECT

S. A. Levine: I can do no more than restate the roentgenologist's summary. Faced with the same circumstances again, I would not know which way to turn, aneurysm or tumor. Tumor of the lungs is rarer in females than in males, but so is aneurysm. As years go on, all syphilitic processes will continue to decrease in frequency, and I am afraid tumors will not. Probably next time when the evidence is pretty evenly matched, as was the case here, the diagnosis of tumor will be correct. It must be stated, however, that without the two laboratory procedures, *i.e.*, the blood test and the x-ray, the clinical diagnosis of aneurysm would have been made. Nevertheless, laboratory tests are much more often helpful than otherwise.

CASE REPORTS

Polyostotic Fibrous Dysplasia[1]

LEWIS E. ETTER, Major, M.C., A. U. S.,
and
JOHN W. HURST, M.D.
Altoona, Penna.

In the course of our examination of candidates for induction into the United States Army an example of a rather rare clinical syndrome was encountered. While this disease has been described in the literature under a variety of names, the one suggested by Lichtenstein (1)—polyostotic fibrous dysplasia—appears satisfactory and has been adopted in describing the present case.

McCune and Bruch (2) and Albright (3) and associates have reviewed the literature on this subject through 1937 summarizing some 21 cases. In 1942 Lichtenstein and Jaffe (4) added 15 new cases, which with 75 previously reported brought the total to that date to 90. The characteristic features of the syndrome are: (1) predominantly unilateral skeletal changes; (2) pigmented areas, in most cases roughly corresponding to the region of bony involvement; (3) sexual precocity in females. Moreover, the disease is more likely to occur in women than in men.

Of unknown cause, the disease usually has its inception early in childhood, which suggests a congenital nature. Its course is one of slow chronicity. It is rarely fatal, which accounts for the lack of autopsy material for exhaustive pathologic study. Usually the course is marked by pathologic fractures, frequently of the humeri or femora, sometimes by a limp, and pains in an extremity. In our case there was only a questionable rib fracture, to be described later; there was no history of pain at any time.

[1] From the X-Ray Department, U. S. Army Recruiting and Induction Station, Altoona, Pa. Approved for publication Dec. 10, 1942, by the Surgeon General, U. S. Army, by authorization of the Board for Review of Manuscripts for Publication. Accepted for publication in January 1943.

CASE REPORT

A. O. J., white, single male, of American descent, now 23 years old, weighing 136 pounds, is 5 1/2 feet tall. His father was born in Pennsylvania and was 38 years old at the birth of this boy. The mother was born in Virginia and was 32 years old at the birth of her son. He was born at home, with a physician in attendance, and was the last of seven

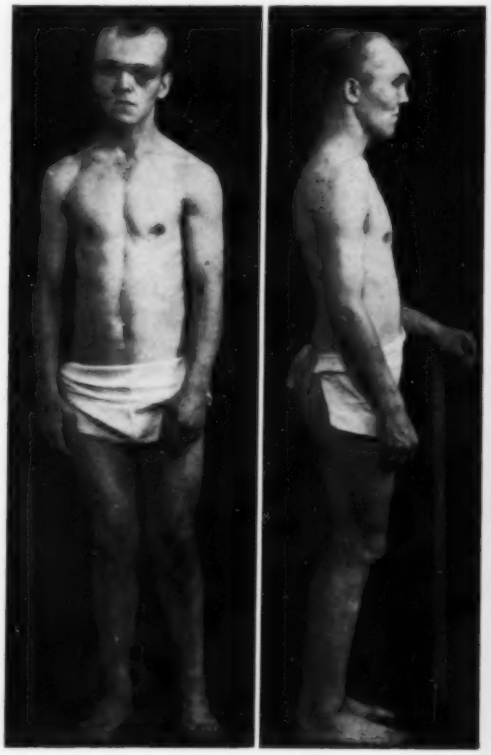

Fig. 1. Showing general appearance of patient; disproportionately large head; depression in frontal bone; prognathous lower jaw; asymmetrical position of eyes; enlarged right clavicle; slight dorso-lumbar curvature to the right; legs bowed forward, and genu valgum.

children. Birth weight was 6 1/2 pounds. Two sisters and three brothers are living. The exact cause of death of the remaining sister is unknown, but it is believed to have been cerebral embolism from rheumatic endocarditis. No physical abnormality is apparent in the living siblings or parents.

No instruments were used during labor, which lasted forty-eight hours, but the mother thought there might have been a birth injury, since she

noticed some abnormality of the head and unusual position of the eyes in early infancy. There was a considerable delay in eruption of the teeth, a full set not being present until three years of age. The child sat up at six to eight months, walked at eleven months, and talked at one and one-half years.

The patient completed the sophomore year in high school and is of average intelligence. Emotionally he seems stable and well adapted to his environment, and has a pleasing personality. He is readily co-operative and not self-conscious about his unusual appearance. Onset of puberty was at thirteen and sexual evolution was normal. The genitalia are normally developed.

There has been noticeable enlargement of the cranial bones since childhood, with no material changes in recent years. There has been, however, a progressive enlargement of the right clavicle. The patient has at no time experienced pain in any of the affected bones except when he was struck on the right side of the chest in the winter of 1938. A roentgenogram of the chest reveals a healed pathologic fracture at the site of this injury in the seventh right rib posteriorly.

The head appears disproportionately large (Fig. 1), and there is a depression in the frontal bone above the glabella. The lower jaw in profile appears prognathous and there is a prominent supraorbital ridge. There is pronounced asymmetry in the position of the eyes, the left being 1.8 cm. below the right.

Fig. 2. Roentgenogram of skull, showing thickening of outer table of frontal, parietal, and occipital bones, especially on the right side; thickening of the right zygoma; cystic appearance of the mandible due to areas of rarefaction and condensation.

The right clavicle is enlarged and the arms appear slightly long in proportion to the trunk. From the side there are noticed a slight lowering of the head and stoop of the shoulders (Fig. 1). There is a very slight dorsolumbar curvature to the right. The legs are bowed a little forward at the knees and genu valgum is observed (Fig. 1). There is malocclusion of the teeth, which are irregularly placed in the jaws.

Multiple small nevi are seen, predominantly on the right side of the head, neck, and trunk, corres-

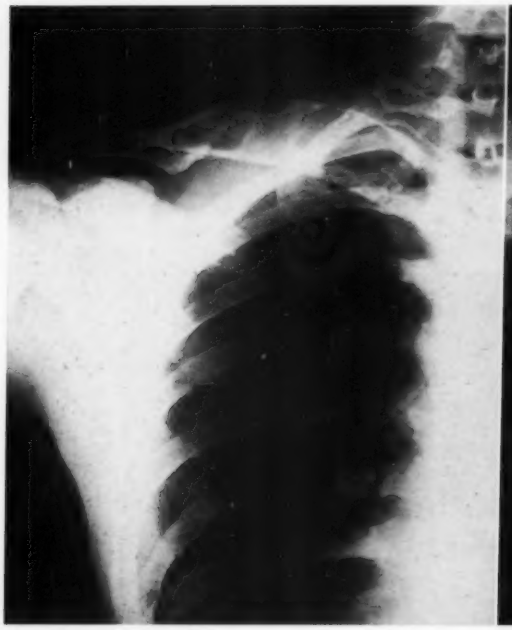

Fig. 3. The right clavicle shows expansion of the medullary cavity, over-all enlargement of the bone, extreme thinning of the cortex, with large, irregularly shaped radiolucent areas.

Fig. 4. There are irregular translucent areas in the head and neck of the right scapula, together with a suggestion of osteoporosis in the coracoid and acromion processes.

ponding in distribution to the bony deformities. Both upper eyelids have a tendency to ptosis, but vision and hearing are not affected.

The heart, lungs, and abdominal viscera are normal. The thyroid gland is not palpable. Blood pressure, measured in millimeters of mercury, is 135 systolic and 80 diastolic.

Neurological findings are negative, sensation being normal in all areas. There is no tenderness on pressure in any of the affected bones and no subjective complaint of pain, as mentioned above.

The Wassermann reaction and urinalysis were negative. The red blood count was 5,210,000; white blood count 7,240, with polymorphonuclear leukocytes 56 per cent, small lymphocytes 28 per cent, large lymphocytes 6 per cent, large mononuclears 6 per cent, transitional cells 3 per cent, and eosinophiles 1 per cent. The value for blood phosphorus was 2.7 mg. per 100 c.c., blood calcium 10.0 mg. per 100 c.c., and serum phosphatase 3.9 Bodansky units.

An attempt was made to secure a biopsy specimen for pathological study, but permission was refused.

Roentgen examination of the skeleton shows the following changes:

Skull (Fig. 2): There is a considerable enlargement of the cranial vault as a whole. The outer table of the frontal, parietal, and occipital bones is greatly thickened, especially on the right side. The base of the skull is relatively unaffected. The wooly appearance of these skull bones is not unlike that seen in Paget's disease, except for the osteoporotic areas. The inner table is fairly intact. There is definite thickening of the right zygoma. In the central portion of the mandible, areas of rarefaction and condensation are seen, giving the bone a cystic appearance.

Ribs (Fig. 3): The 7th, 9th, and 10th ribs on the right side show expansion, thinning of the cortex with almost complete fibrous degeneration of all but a small portion of the proximal end of the 9th rib, coarse trabeculation and cystic areas extending to the costochondral articulations. The posterior portion of the 7th rib shows an appearance suggestive of a healed pathologic fracture.

Right Clavicle (Fig. 3): All but the outer one-third of the right clavicle shows much expansion of the medullary cavity, over-all enlargement of the bone, extreme thinning of the cortex, with large, irregularly shaped radiolucent areas.

Left Clavicle: The left clavicle shows only slight cystic changes at the sternal end.

Righi Scapula (Fig. 4): There are irregular translucent areas in the head and neck of the right scapula, with a suggestion of osteoporosis in the coracoid and acromion processes.

Left Scapula: Only a small cyst-like area is seen in the coracoid process of the left scapula.

Right Humerus (Fig. 5): In the internal epicondyle and supracondylar region are seen evidences of cyst-like changes.

Right Radius (Fig. 5): The proximal third of the right radius shows enlargement of the bone with expansion of the medullary canal, coarse trabeculation, and thinning of the cortex. The distal third shows beginning changes not yet distinctly evident.

Lumbar Spine: All five lumbar vertebrae show alternating radiolucent and radiopaque areas suggestive of cyst formation but with no change in contour of the vertebral bodies.

The bones of the entire left upper extremity, ribs on the left side, the right hand, right ulna, the pelvis, sacrum, coccyx, and both lower extremities are normal.

COMMENT AND SUMMARY

It is our opinion that the osseous lesions presented by this subject are definitely characteristic of polyostotic fibrous dysplasia. The principal points in favor of this diagnosis are: (1) early age (4) of conspicuous bone deformity, particularly of the skull, as observed by the mother in early infancy; (2) predominantly unilateral skeletal involvement, in this instance of the right side; (3) pigmentation of the skin, in the form of multiple nevi, corresponding in distribution to the region of bone involvement; (4) essentially normal biochemical findings.

A rather remarkable feature of this case is the absence of pathological changes in the pelvis or either lower extremity at the time of our examination. While the bones of the skull and jaws are second only to the femora and humeri in frequency of involvement by fibrous dysplasia, the bones more rarely diseased, namely, the right clavicle, scapula, and lumbar vertebrae, also showed changes in this patient.

The normal biochemical values on blood study and the unilateral involvement serve effectively to differentiate the lesions in our case from those seen in von Recklinghausen's disease (osteitis fibrosa cystica) in which the classical changes due to excessive parathyroid secretion are evident. We are in accord with Horwitz and Cantarow (6) in feeling that no benefit would derive from surgical exploration of the parathyroids in this or in other patients showing similar bone disease.

Fig. 5. In the internal epicondyle and supracondylar region are seen evidences of cyst-like changes. The right radius shows enlargement of the bone with expansion of the medullary canal, coarse trabeculation, and thinning of the cortex.

NOTE: Since the above report was accepted for publication, an infant niece of the patient, the eight-weeks-old daughter of a brother, has been found to have hypertelorism and a soft-tissue swelling in the mid-line over the forehead. She is the third child of normal parents, each 27 years of age, and was born at term, with no difficulty during delivery. Her two sisters, 2 and 3 years of age, are normal. Neither the physical examination nor the child's history reveals any other abnormalities. Skull films show wide spacing of the orbits and a questionable defect in the frontal bone.

REFERENCES

1. LICHTENSTEIN, LOUIS: Polyostotic Fibrous Dysplasia. Arch. Surg. **36:** 874-898, May 1938.

2. McCUNE, D. J., AND BRUCH, HILDE: Osteodystrophia Fibrosa: Report of a Case in Which the Condition Was Combined with Precocious Puberty, Pathologic Pigmentation of the Skin and Hyperthyroidism, with a Review of the Literature. Am. J. Dis. Child. **54:** 806–848, October 1937.

3. ALBRIGHT, F., BUTLER, A. M., HAMPTON, A. O., AND SMITH, P.: Syndrome Characterized by Osteitis Fibrosa Disseminata, Areas of Pigmentation and Endocrine Dysfunction, with Precocious Puberty in Females: Report of Five Cases. New England J. Med. **216:** 727–746, April 29, 1937.

4. LICHTENSTEIN, L., AND JAFFE, H. L.: Fibrous Dysplasia of Bone. Arch. Path. **33:** 777–816, June 1942.

5. ADAMS, C. O., COMPERE, E. L., AND JEROME, J.: Regional Fibrocystic Disease. Surg. Gynec. & Obst. **71:** 22–32, July 1940.

6. HORWITZ, THOMAS, AND CANTAROW, ABRAHAM: Polyostotic Fibrous Dysplasia: Case. Arch. Int. Med. **64:** 280–285, August 1939.

1101 Fourteenth Ave.
Altoona, Penna.

Spontaneous Internal Biliary Fistula and Intestinal Obstruction Due to Gallstones[1]

PHILIP J. SANTORA, M.D.

Newark, N. J.

The following case is not only interesting but instructive, since the diagnosis was made entirely upon the roentgen findings. The value of these findings lay in the differentiation between the barium-filled biliary ducts and the surrounding loop of small intestine.

M. H., an Irish housewife, aged 69, entered the hospital complaining of weakness, malaise, and intermittent diffuse abdominal pains for the past four weeks. She gave a history of loss of appetite, frequent vomiting after meals, constipation for the past week, and some loss of weight. There had been no blood in the stools and no hematemesis.

The past history was non-contributory. The patient did not appear to be acutely ill. Physical examination showed evidence of effusion in the chest, tenderness in the mid-abdomen, and pain in the left lower quadrant. Peristalsis was not visible and there was no marked abdominal distention. Except for a small amount of hard feces, rectal examination was negative. Other observations were of no special significance.

[1] Accepted for publication in December 1942.

Fig. 1. Roentgenogram showing the barium-filled biliary tract. 1. The stomach. 2. The duodenum. 3. The gallbladder. 4 and 5. Hepatic ducts. 6. Cystic duct. 7. Point of obstruction of the terminal third of the ileum, 20 cm. from the ileocecal valve.

Roentgen examination of the chest three weeks following admission showed an encapsulated pleural effusion. A flat plate of the abdomen revealed evidence of obstruction in the distal third of the ileum. A barium enema was expelled with great force but barium given by mouth was retained and roentgenograms were made. These showed complete obstruction of the ileum in its distal third in close proximity to the cecum. The biliary tract was filled with barium. Operation showed obstruction of the ileum, 20 cm. from the ileocecal valve. Three gallstones were discovered at the point of obstruction. The patient died two days postoperatively. There was no autopsy.

In the case recorded the passage of gallstones through the biliary tract into the duodenum had produced a fistula and resulted in obstruction of a mechanical nature within the distal third of the ileum. A scout film of the abdomen might have shown the presence of air in the biliary tract and intestinal obstruction.

361–363 Roseville Ave.
Newark, N. J.

EDITORIAL

Howard P. Doub, M.D., Editor

John D. Camp, M.D., Associate Editor

Tropical Diseases of Interest to the Radiologist[1]

The airplane and the world-wide scope of our present conflict have resulted in the exposure of large numbers of our countrymen to tropical diseases of various kinds. Clinical information concerning many of the diseases is still relatively limited and radiological knowledge even more so. The following data, however, are reasonably well established, and may be of some value to radiologists called upon to examine persons exposed to the diseases in question.

Malaria: This is by far the most important tropical disease at the present time. The only reason for mentioning it in a radiological discussion is that a small number of persons will return to this country during a remission, and will be sent for x-ray examination of the abdomen for one reason or another (gastro-intestinal studies, urological studies, etc.). The patient may fail to give a history of malaria and occasionally may be unaware that he has had the disease. Careful examination of the plain films may reveal an enlarged spleen, which should always be noted. We have seen three instances in which a diagnosis of malaria was first suggested by the radiologist on observing a considerably enlarged spleen in a plain film of the abdomen. Needless to say, there are many other diseases and conditions in which splenomegaly is found, but this observation may lead to a suitable blood study and thereby establish an important diagnosis incidental to the condition from which the patient is suffering.

Filariasis: There are some eight types of filariae which infect man. The most important is *F. bancrofti* (or *Wuchereria bancrofti*), which causes that variety of filariasis complicated by elephantiasis. Persons returning from Samoa and certain other South Pacific areas may be found to have localized areas of lymphangitis on the upper arms or upper legs, with or without a history of testicular or scrotal swelling. Microscopic examination of an enlarged regional lymphatic or lymph node in some of these cases will reveal the adult filarial worm (which may reach as much as 6 cm. in length); in other cases examination of the blood may reveal the microfilariae. After a variable number of months, or possibly years, some of the filariae die and become calcified, producing small recognizable opacities in roentgenograms of involved areas, notably the subcutaneous tissues, the lymph nodes and the scrotal lymphatics (1). They appear as small linear or dot-like shadows, often about 1 mm. in diameter, or 1 × 4 mm. in length, and not so large as the usual phlebolith.

The next most important type of filariasis is that due to *Onchocerca volvulus* (the "blinding filaria"), which causes subcutaneous nodules (especially on the head), and sometimes impaired vision. A rare type of infestation is loasis, due to a filaria called *Loa loa*, which causes somewhat similar changes; this particular filaria may be found under the conjunctiva.

There is a long worm, formerly called *F. medinensis*, but now known as *Dracunculus medinensis* (the guinea worm), which may lie in the subcutaneous and other tissues; the male is about 2 cm. in length

[1] The opinions and views set forth in this article are those of the writer and are not to be considered as reflecting the policies of the Navy Department.

but the female may reach 100 cm. (one meter!); both are about 0.7 mm. in diameter. If retained after it dies, the worm often calcifies and appears as a segmented linear or coiled shadow. Beal (2) has reported the occurrence of these calcified filariae in roentgenograms of the leg, chest, and abdomen, but they are most commonly seen in the subcutaneous tissues of the lower extremity. They are quite large and easily recognized in films.

Amebic Dysentery: The radiologist is rarely called upon to examine acute cases of amebic dysentery. He may, however, be asked to examine some of the chronic cases, and in such event should always carefully scrutinize the liver shadows. We have seen amebic abscess of the liver correctly diagnosed by attention to a displaced stomach (abscess in the left lobe of the liver), as well as by attention to a displaced colon (abscess of the right lobe). There are no characteristic roentgen findings in amebic enteritis. Variable degrees of irritability or inflammatory mucosal changes may be found, especially in the cecum, but these are not specific. Silent amebic abscess of the lung may be found associated with liver abscesses, emphasizing the importance of careful scrutiny of the lungs at time of fluoroscopy.

Paragonimiasis: This relatively rare disorder is due to *Paragonimus westermani* (*P. ringeri*) and has been seen in persons returning from Samoa and adjacent islands. There are three clinical forms: the pulmonary, the abdominal, and the cerebral. The most important of these from the point of view of the radiologist is the pulmonary, a disease long known under the term "endemic hemoptysis." It is caused by infection with a small fluke, some 8 mm. in length and 2 mm. in thickness. In chronic cases there is thickening of the pulmonary markings in the base of each lung, with variable degrees of nodulation, due to associated inflammation. The operculated eggs will be found on careful examination of the sputum. The x-ray findings in the lungs are not characteristic, but in the presence of a history of intermittent hemoptysis with cough and appropriate geographic exposure, careful attention should be paid to accentuation of the bronchovascular markings in the lower halves of the lungs. A few cases will show frank bronchiectasis or cavitation.

Dengue: Dengue and dengue-like fevers (including sandfly fever) may come to the attention of the radiologist by reason of a request for x-ray examination of the bones and joints. We are not aware of any characteristic x-ray findings.

Typhus and Other Rickettsial Diseases: The rickettsial diseases include louse typhus, rat flea typhus, tick typhus, and mite fever, and probably, also, "Q" fever and trench fever. While these conditions are of considerable clinical importance there are no roentgen features sufficiently obvious for the present discussion.

Yellow Fever, Cholera, Plague and the Various Relapsing Fevers. These have no common findings of outstanding radiological interest, except perhaps for the pneumonic form of plague.

Leptospiroses: Of these, Weil's disease is noteworthy for its hepatomegaly.

Hookworm disease has no specific x-ray findings.

Ascariasis is sometimes of interest since the worm may be outlined with barium during examination of the gastro-intestinal tract, and occasionally a bolus of worm may cause intestinal obstruction. The male worm averages 20 × 0.3 cm., the female 30 × 0.5 cm.

Schistosomiasis is due to one of three types of blood fluke (*S. hematobium, S. mansoni, S. japonicum*). The first type causes bilharziasis or endemic hematuria. Roentgenograms often show calcific streaks in the walls of the bladder, ureter, and renal pelvis; in some cases there is calcification of the bladder wall, with stones. The densities are due to calcification of dead ova lying in the submucosal tissue (3). Both ova and adult worms may reach the lungs and result in diffuse nodulation (4). *S. mansoni* produces rectal bilharziasis with bloody diarrhea and fistulae, while *S. japonicum* causes intestinal disease.

All three types are associated with splenomegaly and hepatomegaly, notably mansonian schistosomasis.

Trypanosomiasis: The African type of trypanosomiasis is associated with hepatomegaly and splenomegaly, etc. The American type, or Chagas' disease, is associated with cardiac enlargement.

Leishmaniasis: The visceral type of leishmaniasis (kala-azar) is associated with splenomegaly, hepatomegaly, etc. The cutaneous type (Oriental sore and espundia) shows single or multiple chronic ulcers.

Leprosy is largely of academic interest. It is to be remembered, however, that in some cases of the neural type, various degrees of concentric atrophy of the phalanges and small bones of the hands and feet are seen. This concentric atrophy may result in spontaneous amputations and other mutilations. These are not entirely diagnostic, however, since similar findings are present in some other neurotrophic disorders and in certain peripheral vascular diseases. Rarely, true leprous granulomata occur in the bone, resembling other chronic infectious lesions radiologically (5).

Tropical Ulcers: Various types of tropical ulcers (sloughing phagedena) may be encountered, especially of the feet, hands, and face. These are commonly due to spirochetal and bacillary organisms and often involve adjacent bones and joints. X-ray changes are those of a severe infectious osteitis or osteoarthritis.

Ainhum is clinically equivalent to spontaneous amputation of the little toe; it is apparently a neurotrophic disorder. Films show atrophy or disappearance of the phalanges.

Madura foot, or mycetoma, is a fungus infection, usually involving the foot and resulting in chronic swelling, ulceration and sinus formation. The bones and joints show varying degrees of destruction and osteoporosis.

Yaws, Pinta, and Bejel: The last group of tropical diseases of occasional concern to the radiologist is the tropical treponema group. In the chronic or late stages of any of these diseases lesions of bones and viscera similar to those seen in syphilis may be present. We have seen an aneurysm of the aortic arch in a person who was a resident of Cuba for several years which was believed to be due to *Treponema carabeum* (pinta). There was, of course, nothing pathognomonic in the roentgen findings. These patients have positive blood Wassermann reactions and other findings similar to those occurring in syphilis. Peculiar tertiary forms of yaws are (1) goundou, a periostitis and thickening of the nasal processes of the upper maxillae, and (2) gangosa, a destructive ulcerating process of the nasal and oral cavities.

Current information on many of these diseases, and data concerning specific diagnostic tests for some of them, may be obtained from the Army Medical School, Washington, D. C., and the National Institute of Health, Bethesda, Maryland. The National Naval Medical Center at Bethesda has recently issued a revised brochure entitled "Notes on Tropical and Exotic Diseases of Naval Importance," which is of considerable interest.

In summary, then, the radiologist should be of some assistance in the diagnosis of various tropical diseases by paying attention to disorders of the spleen and liver and by increased vigilance in connection with disorders of lungs, bowel, and bones.

L. HENRY GARLAND

U. S. Naval Hospital, Oakland, Calif.

REFERENCES

1. O'CONNOR, F. W., GOLDEN, R., AND AUCHINCLOSS, H.: Roentgen Demonstration of Calcified Filaria bancrofti in Human Tissues. Am. J. Roentgenol. **23:** 494–502, May 1930.

2. BEAL, A. M.: Calcified Guinea-Worm (*Dracunculus medinensis*): Report of Five Cases. Am. J. Roentgenol. **39:** 210–215, February 1938.

3. AFIFI, M. A.: Roentgenographic Manifestations of Urinary Bilharziasis and Calculous Formations in Egypt, and Intravenous Pyelography. Am. J. Roentgenol. **31:** 208–223, February 1934.

4. SHAW, A. F. B., AND GHAREEB, A. A.: Pathogenesis of Pulmonary Schistosomiasis in Egypt, with Special Reference to Ayerza's Disease. J. Path. & Bact. **46:** 401–424, May 1938.

5. CHAMBERLAIN, W. E., WAYSON, N. E., AND GARLAND, L. H.: Bone and Joint Changes of Leprosy: Roentgenologic Study. Radiology **17:** 930–939, 1931.

ANNUAL MEETING: RADIOLOGICAL SOCIETY OF NORTH AMERICA

Members of the Radiological Society of North America are urged to bear in mind the forthcoming meeting of the Society. According to present plans this will be held in Chicago, at the Drake Hotel, Nov. 29–Dec. 3, 1943.

Our British colleagues, in spite of nearly four years of war and the heavy demands made upon the profession in both military and civilian service, continue to hold their annual sessions, recognizing the need of the stimulus provided by these gatherings. American radiologists will find the meeting in December an essential aid in the new problems which they are daily facing.

AMERICAN BOARD OF RADIOLOGY

In order to determine the time and place of the next examination of The American Board of Radiology, it is requested that all those who contemplate applying for certification within the next year file their applications immediately. The officers of the Board can then determine whether it would be advisable to conduct an examination at the time of the meeting of the Radiological Society of North America.

B. R. KIRKLIN, M.D., *Secy.*
Rochester, Minn.

INTER-AMERICAN RADIOLOGICAL CONGRESS

A recent communication from Dr. José F. Merlo Gómez, President of the Inter-American Radiological Congress to be held in Buenos Aires in October, states that preparations are going forward and that a representative gathering of South American radiologists is anticipated. Our South American colleagues are most desirous that North America should also be represented at the Congress, that it may be truly Inter-American in fact as well as in name. If any member of the Radiological Society of North America finds it possible to attend, he should communicate with Dr. Donald S. Childs, Secretary of the Society, in order that his credentials may be forwarded to Doctor Gómez. The period for enrollment expires sixty days before the opening of the Congress. Fuller details appeared in the May issue of RADIOLOGY.

NEW YORK ROENTGEN SOCIETY

The newly elected officers of the New York Roentgen Society are Dr. Ross Golden, President; Dr. Maurice M. Pomeranz, Vice-president; Dr. Haig H. Kasabach, Presbyterian Hospital, Secretary; Dr. William H. Boone, Treasurer; Dr. Roy D. Duckworth, Member of the Executive Committee.

THE AMERICAN CONGRESS OF PHYSICAL THERAPY

The American Congress of Physical Therapy will hold its twenty-second annual scientific and clinical session Sept. 8–11, at the Palmer House, Chicago. The annual instruction course will be conducted from 8 : 00 to 10 : 30 A.M. and from 1 : 00 to 2 : 00 P.M., Sept. 8, 9, and 10, and will include a round-table discussion from 9:00 to 10:30 A.M., Sept. 9. The scientific and clinical sessions will occupy the remainder of the time. They will be open to all members of the medical profession and their qualified aides. For information concerning the instruction course and program, address the American Congress of Physical Therapy, 30 North Michigan Ave., Chicago, Ill.

In Memoriam

CORNELIUS G. DYKE, M.D.

1900–1943

Dr. Cornelius G. Dyke died of acute myelogenous leukemia on April 23, 1943, at the age of forty-two.

Doctor Dyke was born in Orange City, Iowa, where he graduated from high school. After a year at Morningside College, Sioux City, Iowa, he went to the State University of Iowa, where he was granted the degree of Bachelor of Science and, in 1926, of Doctor of Medicine. He served his internship at the Navy Hospital, Chelsea, Mass., and then spent two years as resident in Radiology at the Peter Bent Brigham Hospital, under Dr. Merrill C. Sosman. While there, he became particularly interested in the diagnosis of brain tumors through his contact with the rich material attracted to that institution by Dr. Harvey Cushing. Through a study of approximately three thousand cases, he contributed to the establishment of normal limits in the position of the shadow of the calcified pineal gland on skull films. In 1929 he went to the Neurological Institute, New York City, as the assistant to Dr. Charles Wadsworth Schwartz. During the succeeding years, he applied himself assiduously to the study of diseases of the brain and skull. He was accustomed to spend three nights a week and alternate week-ends working with the material at the Neurological Institute in association with members of the staff, particularly with Dr. Leo M. Davidoff. The result was a series of important papers on the roentgen manifestations of diseases of the brain and spinal cord, particularly the neoplasms. Many contributions to the evolution of encephalography came from the Neurological Institute in which he played a major role. Through his continuous and

unremitting study of the large number of cases available there, he became extraordinarily skilled in the interpretation of encephalograms. In collaboration with Davidoff, he published an important book on the normal encephalogram and another on roentgen therapy of diseases of the nervous system. A book on the abnormal encephalogram was uncompleted at his death. He contributed important chapters on the roentgen diagnosis of diseases of the brain and spinal cord to Nelson's *Loose Leaf Diagnostic Roentgenology* and to Nelson's Systems of Medicine and Surgery. He called attention to the widening of the space between the shadows of the pedicles of the vertebrae produced by certain tumors of the spinal cord and prepared a chart showing the normal measurements of the interpediculate spaces throughout the entire length of the spine.

At his death, Doctor Dyke was Director of the Roentgen-Ray Department of the Neurological Institute and was Associate Professor of Radiology of the College of Physicians and Surgeons, Columbia University. He was a charter member and past president of the Harvey Cushing Society and was First Vice-President of the American Roentgen-Ray Society. He was a member of the New York Roentgen Society, a Fellow of the New York Academy of Medicine, and of the American College of Radiology.

His fine character and unselfish devotion to the science and art of medical radiology stimulated the confidence and aroused the admiration of those who came in contact with his work, as well as the enduring affection of his personal friends.

ROSS GOLDEN, M.D.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

SKIN GRAFTING OF BURNS, PRIMARY CARE, TREATMENT, REPAIR. By JAMES BARRETT BROWN, M.D., Lieutenant Colonel, Medical Corps, Army of the United States; Senior Consultant in Plastic and Maxillo-Facial Injuries and Burns, E.T.O. U.S.A., Associate Professor of Surgery, Washington University, St. Louis, Missouri, and FRANK MCDOWELL, M.D., Assistant in Clinical Surgery, Washington University, St. Louis, Missouri. A volume of 204 pages with 131 illustrations. Published by J. B. Lippincott Company, Philadelphia, Penna. Price $5.00.

Book Reviews

CLINICAL SIGNIFICANCE OF THE BLOOD IN TUBERCULOSIS. By GULLI LINDH MULLER, M.D., Pathologist and Director of Laboratory, New England Hospital for Women and Children, Boston; formerly Pathologist, Rutland State Sanatorium, Rutland, Mass. A volume of 536 pages. Published by The Commonwealth Fund, New York. Price $3.50.

This work is a really exhaustive review of the literature combined with the author's own research in the hematology of tuberculosis. To bear in mind that clinical as well as hematological abnormalities are constitutional responses to the tuberculous focus makes understandable some of the discrepancies found between these symptoms and the anatomical lesions as revealed by the roentgenogram. The correlation of the different stages of the disease, the tissue responses, and complications with the hematologic changes is well shown by Doctor Muller and the methods used are clearly presented. The book is a valuable summary of the means at our disposal for assessing the patient's constitutional response to tuberculosis as shown in the hemogram and erythrocyte sedimentation rate.

A MANUAL OF PULMONARY TUBERCULOSIS (Part I) and AN ATLAS OF THORACIC ROENTGENOLOGY (Part II). By DAVID O. N. LINDBERG, M.D., F.A.C.P., Lecturer on Tuberculosis, State University of Iowa, College of Medicine; Director of Roentgenology, State Sanatorium, Iowa. A volume of 219 pages, plus Index, with 189 illustrations including 145 plates. Published by Charles C Thomas, Springfield, Ill. Price $6.50.

As its title implies, this book is a manual covering the diagnosis and treatment of pulmonary tuberculosis. It is brief to the point of being superficial in its treatment of the subject. It is not a book, therefore, for the specialist but would be of value to students or to general practitioners.

It is divided into two parts. Part I consists of chapters on diagnosis, roentgenologic technic and interpretation, general management, surgical considerations, and control aspects. Part II is an atlas of 145 roentgenograms, supplementing the text of Part I. This could have been made more valuable if fuller descriptions of the roentgen signs depicted on the films had been included in the legends. The book is well printed and bound and there is an adequate index.

RADIOLOGICAL SOCIETIES OF NORTH AMERICA

Editor's Note.—Will secretaries of societies please cooperate by sending information to Howard P. Doub, M.D., Editor, Henry Ford Hospital, Detroit, Mich.

UNITED STATES

Radiological Society of North America.—Secretary, D. S. Childs, M.D., 607 Medical Arts Building, Syracuse, N. Y.

American Roentgen Ray Society.—Secretary, Harold Dabney Kerr, M.D., Iowa City, Iowa.

American College of Radiology.—Secretary, Mac F. Cahal, 540 N. Michigan Ave., Chicago, Ill.

Section on Radiology, American Medical Association—Secretary, J. T. Murphy, M.D., 421 Michigan St., Toledo, Ohio.

ARKANSAS

Arkansas Radiological Society.—Secretary-Treasurer, J. S. Wilson, M.D., Monticello. Meets every three months and annually at meeting of State Medical Society.

CALIFORNIA

California Medical Association, Section on Radiology.—Secretary, Joseph D. Coate, M.D., 434 Thirtieth St., Oakland.

Los Angeles County Medical Association, Radiological Section.—Secretary, Donald R. Laing, M.D., 65 N. Madison Ave., Pasadena. Meets second Wednesday of each month at County Society Building.

Pacific Roentgen Society.—Secretary-Treasurer, L. Henry Garland, M.D., 450 Sutter St., San Francisco. Society meets annually during annual meeting of the California Medical Association.

San Francisco Radiological Society.—Secretary, Sydney F. Thomas, M.D., San Francisco Hospital. Meets monthly on third Thursday at 7:45 P.M., in Toland Hall, University of California Hospital.

COLORADO

Denver Radiological Club.—Secretary, Edward J. Meister, M.D., 366 Metropolitan Bldg. Meetings third Friday of each month at the Denver Athletic Club.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—Secretary-Treasurer, Max Climan, M.D., 242 Trumbull St., Hartford. Meetings bimonthly, on second Thursday. Place of meeting selected by Secretary.

FLORIDA

Florida Radiological Society.—Acting Secretary, Walter A. Weed, M.D., 204 Exchange Building, Orlando.

GEORGIA

Georgia Radiological Society.—Secretary-Treasurer, James J. Clark, M.D., 478 Peachtree St., N. E., Atlanta. Meetings twice annually, in November and at the annual meeting of State Medical Association.

ILLINOIS

Chicago Roentgen Society.—Secretary, Warren W. Furey, M.D., 6844 S. Oglesby Ave. Meets at the Palmer House, second Thursday of October, November, January, February, March, and April.

Illinois Radiological Society.—Secretary-Treasurer, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly by announcement.

Illinois State Medical Society, Section on Radiology.—Secretary, Fay H. Squire, M.D., 1753 W. Congress St., Chicago.

INDIANA

The Indiana Roentgen Society.—Secretary-Treasurer, Harold C. Ochsner, M.D., Methodist Hospital, Indianapolis. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

KENTUCKY

Kentucky Radiological Society.—Secretary-Treasurer, Sydney E. Johnson, M.D., Louisville City Hospital, Louisville. Meeting annually in Louisville, third Saturday afternoon in April.

LOUISIANA

Louisiana Radiological Society.—Secretary-Treasurer, Johnson R. Anderson, M.D., North Louisiana Sanitarium, Shreveport. Meets annually at same time as State Medical Society.

Shreveport Radiological Club.—Secretary-Treasurer, R. W. Cooper, 940 Margaret Place. Meetings monthly on the second Wednesday, at the offices of the various members.

MARYLAND

Baltimore City Medical Society, Radiological Section.—Secretary, Walter L. Kilby, M.D., 101 W. Read St. Meetings are held the third Tuesday of each month.

MICHIGAN

Detroit X-ray and Radium Society.—Secretary-Treasurer, E. R. Witwer, M.D., Harper Hospital, Detroit. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society club rooms, 4421 Woodward Ave., Detroit.

Michigan Association of Roentgenologists.—Secretary-Treasurer, E. M. Shebesta, M.D., 1429 David Whitney Bldg., Detroit. Meetings quarterly by announcement.

MINNESOTA

Minnesota Radiological Society.—Secretary, John P. Medelman, M.D., 572 Lowry Medical Arts Bldg., St. Paul. Meetings quarterly.

MISSOURI

Radiological Society of Greater Kansas City.—Secretary, Arthur B. Smith, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—Secretary, Paul C. Schnoebelen, M.D., 462 N. Taylor Ave. Meets on fourth Wednesday of each month except June, July, August, and September, at a place designated by the president.

NEBRASKA

Nebraska Radiological Society.—Secretary, F. L. Simonds, M.D., 1216 Medical Arts Bldg., Omaha. Meetings third Wednesday of each month at 6 P.M. in either Omaha or Lincoln.

NEW ENGLAND

New England Roentgen Ray Society (Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island).—*Secretary,* Hugh F. Hare, M.D., Lahey Clinic, Boston, Mass. Meets monthly on third Friday at Boston Medical Library.

NEW JERSEY

Radiological Society of New Jersey.—Secretary, H. J. Perlberg, M.D., Trust Co. of New Jersey Bldg., Jersey City. Meetings at Atlantic City at time of State Medical Society and midwinter in Newark as called by president.

NEW YORK

Associated Radiologists of New York, Inc.—Secretary, William J. Francis, M.D., 210 Fifth Ave., New York City. Regular meetings the first Monday evening of the month in March, May, October, and December.

Brooklyn Roentgen Ray Society.—Secretary-Treasurer, Leo Harrington, M.D., 880 Ocean Ave. Meetings held the fourth Tuesday of every month, October to April.

Buffalo Radiological Society.—Secretary-Treasurer, Joseph S. Gianfranceschi, M.D., 610 Niagara St. Meetings second Monday evening each month, October to May, inclusive.

Central New York Roentgen Ray Society.—Secretary-Treasurer, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse. Meetings are held in January, May, and October, as called by Executive Committee.

Long Island Radiological Society.—Secretary, Marcus Wiener, M.D., 1430 48th St., Brooklyn. Meetings fourth Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—Secretary, Haig H. Kasabach, Presbyterian Hospital, New York, N. Y.

Rochester Roentgen-ray Society.—Secretary, S. C. Davidson, M.D., 277 Alexander St. Meetings at convenience of committee.

NORTH CAROLINA

Radiological Society of North Carolina.—Secretary-Treasurer, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meeting with State meeting in May, and meeting in October.

NORTH DAKOTA

North Dakota Radiological Society.—Secretary, L. A. Nash, M.D., St. John's Hospital, Fargo. Meetings by announcement.

OHIO

Ohio Radiological Society.—Secretary, J. E. McCarthy, M.D., 707 Race St., Cincinnati. The next meeting will be held at the time and place of the annual meeting of the Ohio State Medical Association.

Cleveland Radiological Society.—Secretary-Treasurer, J. O. Newton, M.D., 13921 Terrace Road, East Cleveland. Meetings at 6:30 P.M. at the Mid-day Club, in the Union Commerce Bldg., on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*Secretary-Treasurer,* Samuel Brown, M.D., 707 Race St. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—Secretary-Treasurer, L. E. Wurster, M.D., 416 Pine St., Williamsport. The Society meets annually.

The Philadelphia Roentgen Ray Society.—Secretary, Robert P. Barden, M.D., 3400 Spruce St., Philadelphia. Meetings held first Thursday of each month at 8:15 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22nd St., Philadelphia.

The Pittsburgh Roentgen Society.—Secretary-Treasurer, Reuben G. Alley, M.D., 4800 Friendship Ave., Pittsburgh, Pa. Meetings are held on the second Wednesday of each month at 4:30 P.M., from October to June, at the Pittsburgh Academy of Medicine, 322 N. Craig St.

ROCKY MOUNTAIN STATES

Rocky Mountain Radiological Society (North Dakota, South Dakota, Nebraska, Kansas, Texas, Wyoming, Montana, Colorado, Idaho, Utah, New Mexico).—*Secretary,* A. M. Popma, M.D., 220 North First St., Boise, Idaho.

SOUTH CAROLINA

South Carolina X-ray Society.—Secretary-Treasurer, Robert B. Taft, M.D., 103 Rutledge Ave., Charleston. Meeting in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee Radiological Society.—Secretary-Treasurer, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meeting annually with State Medical Society in April.

TEXAS

Texas Radiological Society.—Secretary-Treasurer, Herman Klapproth M.D., Sherman.

VIRGINIA

Virginia Radiological Society.—Secretary E. Latané Flanagan, M.D., 215 Medical Arts Bldg., Richmond.

WASHINGTON

Washington State Radiological Society.—Secretary-Treasurer, Kenneth J. Holtz, M.D., American Bank Bldg., Seattle. Meetings fourth Monday of each month at College Club, Seattle.

WISCONSIN

Milwaukee Roentgen Ray Society.—Secretary-Treasurer, C. A. H. Fortier, M.D., 231 W. Wisconsin Ave., Milwaukee. Meets monthly on second Monday at the University Club.

Radiological Section of the Wisconsin State Medical Society.—Secretary, Russell F. Wilson, M.D., Beloit Municipal Hospital, Beloit. Two-day annual meeting in May and one day in connection with annual meeting of State Medical Society, in September.

University of Wisconsin Radiological Conference.—Secretary, E. A. Pohle, M.D., 1300 University Ave., Madison, Wis. Meets every Thursday from 4 to 5 P.M., Room 301, Service Memorial Institute.

CANADA

Canadian Association of Radiologists.—Honorary Secretary-Treasurer, A. D. Irvine, M.D., 540 Tegler Bldg., Edmonton, Alberta.

La Société Canadienne-Française d'Eléctrologie et de Radiologie Médicales.—General Secretary, Origène Dufresne, M.D., Institut du Radium, Montreal. Meetings are held the third Saturday of each month, generally at the Radium Institute, 4120 East Ontario Street, Montreal; sometimes, at homes of members.

CUBA

Sociedad de Radiología y Fisioterapia de Cuba.—Offices in Hospital Mercedes, Havana. Meetings are held monthly.

ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

COWEN, D., WOLF, A., AND PAIGE, B. H. Toxoplasmic Encephalomyelitis: Clinical Diagnosis of Infantile or Congenital Toxoplasmosis; Survival Beyond Infancy 84

DYKE, C. G., WOLF, A., COWEN, D., PAIGE, B. H., AND CAFFEY, J. Toxoplasmic Encephalomyelitis. Significance of Roentgenographic Findings in the Diagnosis of Infantile or Congenital Toxoplasmosis 84

KORNBLUM, K., AND KENNEDY, G. R. The Sphenoidal Fissure: Anatomical, Roentgenological, and Clinical Study 84

GLOBUS, J. H., AND MELTZER, T. Metastatic Tumors of the Brain 85

CURTIS, L. E., AND FELLER, A. E. Hyperparathyroidism with Calcinosis and Secondary to Renal Disease: Report of a Probable Case .. 85

VOORSANGER, W. C. Arytenoid Extrusion with Roentgenological Studies 85

The Chest

WILLIAMS, M. H. Postpneumonic Empyema in Infants and Children; Treatment by Open Drainage: Thirty-Nine Cases, One Death .. 85

KENT, E. M. Bronchial Obstruction and Pulmonary Atelectasis, as Seen in Childhood Tuberculosis with Secondary Bronchiectasis as Sequela 86

KELLOGG, D. S., AND LINSMAN, J. F. Fenestration of the First Thoracic Ribs 86

WYATT, G. M. Atelectasis Following Pneumonia in Children 86

BLAKE, F. G., HOWARD, M. E., AND TATLOCK, H. Feline Virus Pneumonia and Its Possible Relation to Some Cases of Primary Atypical Pneumonia in Man 86

NAYER, H. R., AND PINNER, M. Chronic Pulmonary Tuberculosis 87

RONCHESE, F. Sarcoid and Tuberculosis: Report of Case with Autopsy 87

CLERF, L. H. Tuberculous Tracheobronchitis ... 88

BENEDICT, E. B. Bronchial Obstruction and Tracheobronchial Tuberculosis 88

MCDOUGALL, J. B. Tuberculosis in England During War 88

KERLEY, P. Technique in Mass Miniature Radiography 89

SANTE, L. R. Roentgen Manifestations of Adult Toxoplasmosis 89

PENDERGRASS, E. P. Some Considerations Concerning the Roentgen Diagnosis of Pneumoconiosis and Silicosis 89

GILLISON, J. A., AND TAYLOR, F. Bagassosis: Further Notes of Four Cases 90

SCHWARZ, H., II, AND WILLIAMS, C. S. Thoracic Gastric Cysts: Report of Two Cases with a Review of the Literature 90

WALDMAN, S. Method for Rapid, Repeated, Approximate Determinations of the Transverse Diameter of the Heart 90

PASTERNACK, J. G. Complete Situs Inversus: Report of a Case with Calcareous Aortic Stenosis and Cor Bovinum 90

The Digestive Tract

NAVILLE, F., AND HERRMANN, R. Radiologic Examination of an Esophageal Spasm May Lead to Error in Localization of the Lesion Causing It 91

DILLON, J. G. Respiratory Function of the Digestive Tract as the Basis of Roentgenographic Life Test 91

MARQUIS, W. J., AND BAKER, C. F. Correlation of Roentgen Ray Diagnosis of Lesions of the Stomach and Duodenum with the Operative Findings and Selected Case Reports 91

RENSHAW, R. J. F., AND CLARK, G. E. Critical Analysis of 938 Gastroscopic Examinations .. 92

SCHINDLER, R., AND LETENDRE, P. Analysis of Relationship of Surgery and Gastroscopy in 95 Cases of Gastric Tumor 92

KIRKLIN, B. R., AND MACCARTY, W. C., JR. Incidence of Malignancy in Prepyloric Ulcers .. 92

DUDLEY, G. S., MISCALL, L., AND MORSE, S. F. Benign Tumors of the Stomach 93

JOLL, C. A., AND ADLER, D. L. Long Survival after Gastrectomy 93

MENNE, F. R., MASON, D. G., AND JOHNSTON, R. Lymphosarcoma of the Intestine: Report of Two Cases 94

The Biliary Tract

LAWRENCE, K. B., AND CLUTE, H. M. Intrinsic Disease of the Liver Simulating Acute Cholecystitis 94

FELDMAN, M., AND GOODMAN, J. E. Varices of the Gallbladder: Associated with a Mucosal Cyst 94

CLUTE, H. M., AND LAWRENCE, K. B. Cholangiographic Artifacts Resembling Common-Duct Stones 94

The Pancreas

RABINOVITCH, J., AND PINES, B. Cysts of the Pancreas 95

The Skeletal System

HARVEY, R. M. Hurler-Pfaundler Syndrome (Gargoylism): Review of the Literature with Report of an Additional Case 95

BRAILSFORD, J. F. Chronic Sub-periosteal Abscess 96

HEFKE, H. W., AND TURNER, V. C. Obturator Sign as the Earliest Roentgenographic Sign in the Diagnosis of Septic Arthritis and Tuberculosis of the Hip 96
CASE RECORDS OF MASSACHUSETTS GENERAL HOSPITAL. Case 28481 96
ENGLANDER, O. Non-traumatic Occipito-Atlanto-Axial Dislocation 97
HART, V. L. Fractures of the Neck of the Femur 97
EPSTEIN, B. S. Laminagraphy of the Sphenoid Bone 97
HAYNES, W. G. Dural Constricting Ring with Cervical Protruded Intervertebral Disk: Report of a Case 97
LEWIS, R. W. Roentgenographic Soft Tissue Study in an Orthopedic Hospital 98

The Genito-Urinary Tract

PENDERGRASS, E. P., CHAMBERLIN, G. W., GODFREY, E. W., AND BURDICK, E. D. Survey of Deaths and Unfavorable Sequelae Following the Administration of Contrast Media ... 98
SMEDAL, M. I. Roentgen-Ray Dosage During Routine Diagnostic Studies 99
ROBINS, S. A. Hypersensitivity to Diodrast as Determined by Skin Tests 99
ARCHER, V. W., AND HARRIS, I. D. An Ocular Test for Sensitivity to Diodrast Prior to Intravenous Urography 100
WILHELM, S. F. Laminagraphy as an Aid in Urological Diagnosis 100
BOTHE, A. E., AND CRISTOL, D. S. Cystic Disease of the Upper Urinary Tract: Pyelitis Cystica and Ureteritis Cystica 100
DEMBO, L. H. Renal Ectopia with Fusion 101
BATSON, O. V. Vertebral Vein System as a Mechanism for Spread of Metastases 101
ALYEA, E. P., AND HENDERSON, A. F. Carcinoma of the Prostate; Immediate Response to Bilateral Orchiectomy: Clinical and X-Ray Evidence 101

The Spinal Cord

GRAY, E. D. Calcification and Ossification of Spinal Tumors 102
CRAIG, R. L. Effect of Iodized Poppyseed Oil on the Spinal Cord and Meninges: Experimental Study 102

Foreign Bodies

MILLER, E. R. Foreign Body Localization by X-Ray 102

RADIOTHERAPY

Technic and Dosage

MEDINGER, F. G., AND CRAVER, L. F. Total Body Irradiation, with Review of Cases 103
ELLIS, F. Tolerance Dosage in Radiotherapy with 200-Kv. X-Rays 103

Malignant Neoplasms

LENZ, M. Roentgen Therapy of Primary Cancer of the Nasopharynx 103
VALENCIA, E., AND ROSENTHAL, L. M. Radiotherapy of Cancer of the Antrum 104
PEARSON, B., AND GARCIA, M. Spread and Metastasis in Carcinoma of the Cervix Uteri 105
KIMBALL, T. S., SANFORD, H. E., AND BROWN, A. F. Carcinoma of the Fallopian Tube 105
LEDERMAN, M., AND MAYNEORD, W. V. Radium Treatment of Cancer of the Vagina 105
BARRINGER, B. S. Five-Year Control of Bladder Cancers by Radon Implants 105

Non-Malignant Disease

HEMPHILL, J. R., AND NOOJIN, R. O. North American Cutaneous Blastomycosis Treated with Superficial Roentgen Therapy: Report of Four Cases 106
SMITH, J. H. X-Ray Therapy in the Treatment of Chronic Pyelonephritis 106

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Toxoplasmic Encephalomyelitis: Clinical Diagnosis of Infantile or Congenital Toxoplasmosis; Survival Beyond Infancy. D. Cowen, A. Wolf, and B. H. Paige. Arch. Neurol. & Psychiat. **48:** 689–739, November 1942.

A study of 9 cases of infantile or congenital toxoplasmic encephalomyelitis recognized at necropsy led to the formulation of a clinical picture of the disease. The outstanding features consisted of striking ocular findings concomitant with neurological signs in newborn or very young infants.

On the basis of these studies, 6 cases in living children were collected. Of the 6 subjects, the majority were children who had survived beyond infancy, indicating that the disease is not necessarily fatal in early infancy and may become chronic or latent. The outstanding symptom is usually diminution in vision, due to the effects of multiple foci of healed chorioretinitis which are readily recognizable by ophthalmoscopic examination. The findings consist of severe, extensive lesions, usually bilateral. These are sharply marginated, irregular, yellowish white, white, or reddish brown, stippled and often bordered with brownish or brownish-black pigment. The eye lesions are usually multiple. Primary optic atrophy is present.

Neurologic signs appear early. Convulsions and internal hydrocephalus, with or without enlargement of the head, are common observations. Microcephaly is sometimes seen. Inasmuch as the toxoplasmic lesions are widely distributed in the central nervous system, other individual findings are less constantly encountered. A variety of findings pertaining to the abdominal viscera, skin, and cardiorespiratory systems are seen in scattered cases.

Roentgenographic demonstration of calcification in the necrotizing cerebral lesions is an outstanding clinical feature of toxoplasmic encephalomyelites. Characteristically these are seen as multiple, bilaterally distributed, small, rounded shadows, ranging from 1 to 3 mm. in diameter. They occur in the cortex of all cerebral lobes and in the basal ganglia and thalami. Intracranial calcification is present in the majority of cases; it may be unilateral in distribution. Other roentgenographic changes consist of enlargement of the skull and fontanels, separation of the sutures, and pneumo-encephalographic evidence of ventricular dilatation. [See following abstract.]

The disease may be fatal within the first few months of life, probably being acquired *in utero*. Survival beyond infancy is apparently more frequently the case. The persisting signs and symptoms depend on the extent of the original neural and ocular injury and on the result of possible interference with cerebrospinal fluid circulation.

DEPARTMENT OF ROENTGENOLOGY,
UNIVERSITY OF MICHIGAN (B. D. J.)

Toxoplasmic Encephalomyelitis. Significance of Roentgenographic Findings in the Diagnosis of Infantile or Congenital Toxoplasmosis. C. G. Dyke, A. Wolf, D. Cowen, B. H. Paige, and J. Caffey. Am. J. Roentgenol. **47:** 830–841, June 1942.

Human toxoplasmosis was first encountered as an encephalomyelitis in infants. It was originally described by Wolf and Cowen (Bull. Neurol. Inst., N. Y. **6:** 306–371, 1937) and the present paper is one of a series by these writers and their associates on its various manifestations [see preceding abstract].

This contribution is based on roentgen studies made in 10 cases, 4 of which were proved at autopsy, while in 6 the diagnosis was made clinically. The most striking roentgenographic evidence of the disease is diffuse intracerebral calcification, which was present in 9 of the patients whose skulls were examined. It usually occurs in small flecks, approximately 2 mm. in diameter, or in streaks, particularly in the basal ganglia or thalami. It must be differentiated from cerebral calcification due to other lesions, as brain tumors, tuberous sclerosis, etc. Evidence of increased intracranial pressure was present in 4 cases in this series. Pneumo-encephalography was done in 3 patients, all of whom showed internal hydrocephalus.

Chest roentgenograms were made in 5 cases. In all but one some evidence of disease was present. In one of these, coming to autopsy, a toxoplasmic myocarditis and pneumonitis were found. [For the pulmonary findings in the adult disease, see abstract of Sante's paper, page 89.]

Numerous roentgenograms are reproduced.

The Sphenoidal Fissure: Anatomical, Roentgenological, and Clinical Study. K. Kornblum and G. R. Kennedy. Am. J. Roentgenol. **47:** 845–858, June 1942.

Alteration in the size, shape, or appearance of the sphenoidal fissure has received little attention from American roentgenologists as an evidence of brain tumor. The authors, however, found it of such value that they have made it the subject of special study.

There is considerable variation in the size and shape of the sphenoidal fissure in normal persons. On the basis of anatomical studies (147 specimens) and roentgen observations (494), six general types were discovered. The predominant type, occurring in about 40 per cent of the examinations, and designated by the authors as normal, measures about 15 mm. in length and 5 mm. at its greatest width. It is largest in its lower and medial portions, being globular or bulbous in shape, tapering off gradually to a point at its upper and outer end. The variants from this type are designated, descriptively, as bulbous, long and narrow, dumbbell, cone-shaped, and unequal (*i.e.*, asymmetrical).

Failure to demonstrate the sphenoid sinus roentgenographically is to be attributed in the majority of cases to poor technic. The authors find a posterior-anterior projection most satisfactory and describe their method. The most important single factor is proper positioning of the head to obtain an "absolute straight postero-anterior view."

In a series of 68 cases of verified brain tumor 19, or 27.9 per cent, showed some abnormality in the sphenoidal fissure. While tumors at a distance (as in the posterior fossa or parietal lobe) may cause such alterations, presumably as a result of a generalized increase in intracranial pressure, presence of an abnormal fissure in the majority of instances indicates a lesion in the immediate vicinity and is thus of localizing value.

While an inequality may normally exist between the fissures on the two sides, this occurs in only a small percentage of cases and may generally be considered of diagnostic significance.

Erosion of bone, due to direct pressure, is the most frequent cause of sphenoidal fissure abnormality as demonstrable roentgenographically. Sphenoidal ridge meningiomas commonly cause erosion of the lesser wing of the sphenoid. They may produce a hyperostosis with narrowing of the sphenoidal fissure. Frontal lobe tumors may lead to erosion in the sphenoidal ridge, fading out as the fissure is reached. Large frontal lobe tumors may cause bilateral changes, in which case the greater degree of involvement of one fissure may indicate the side of origin of the tumor.

The authors warn that sphenoidal fissure changes must be interpreted with great caution and in association with the clinical findings. Six illustrative case reports are included.

Metastatic Tumors of the Brain. J. H. Globus and T. Meltzer. Arch. Neurol. & Psychiat. **48:** 163–226, August 1942.

Of 57 cases of metastatic tumor of the brain, 49 were carcinomas and the remaining 8 were of other types—2 Grawitz tumors, a neuroblastoma, a lymphosarcoma, a spindle-cell sarcoma, a melanosarcoma, a chorionepithelioma, and a Ewing's sarcoma. Indications are that in the predominant number of instances the primary focus is in some part of the respiratory or gastro-intestinal tract. Nineteen of the tumors in this series (33.3 per cent) were primary in the lungs. In all cases in which full postmortem examination was made, metastasis to the brain was found to be but an expression of a generalized process of dissemination. These facts emphasize the importance of roentgen examination, especially of the chest, in establishing the nature of the tumor.

In 52.6 per cent of the total series multiple tumors, variable in size and distribution, were revealed; in 38.6 per cent the metastatic lesion was single and massive, while in 8.8 per cent the dissemination was miliary in type. In all but two instances the tumors were in the brain substance. Of the exceptions, one was restricted to the dura and the other to the leptomeninges. In a few cases successful removal of the tumor was accomplished, resulting in some palliation and prolongation of life beyond the probable expectancy.

Careful analysis of clinical findings in these cases seems to indicate that the onset of cerebral manifestations is most commonly acute and often precipitate, with symptoms of increased intracranial pressure which, early in the disease, are usually of an intensity out of proportion to the then present meager objective neurologic findings. Mental alterations are found in a somewhat greater number of cases of metastatic than of primary tumor of the brain. The early stage is followed by a rapid transition to a stage in which manifestations of an existing focal lesion of the brain are prominent; these may suggest a disseminated process or may point to the presence of a single circumscribed lesion.

DEPARTMENT OF ROENTGENOLOGY,
UNIVERSITY OF MICHIGAN (C. H. B)

Hyperparathyroidism with Calcinosis and Secondary to Renal Disease: Report of a Probable Case. L. E. Curtis and A. E. Feller. Ann. Int. Med. **17:** 1005–1014, December 1942.

"Renal" osteitis fibrosa cystica appears to be an unusual example of parathyroid disease, occurring secondary to renal disease, the adult counterpart of renal rickets in children. The outstanding feature is the curious deposition of calcium about the joints.

A case is presented, in a 40-year-old white male complaining of pain in the knee, hip, shoulder joints, and in the loins. Nocturnal diuresis was also present. Blood chemistry determinations showed a marked azotemia, increased serum inorganic phosphorus, and a normal concentration of serum calcium. Roentgenograms of the skull, pelvis, spine, and extremities revealed a generalized osteoporosis with no cyst formation. The skull had a diffuse, granular appearance with innumerable areas of lessened density. Localized areas of calcium density were present in the soft tissues of the terminal phalanges of all fingers and thumbs. Similar shadows also were observed in the right hip, elbow, and both shoulder joints. Because of the renal insufficiency (probably of long standing), sclerosis of the peripheral arteries and the previous findings, a diagnosis of renal disease with secondary hyperparathyroidism was made. Autopsy showed overgrowth of one parathyroid gland, very small kidneys, generalized osteitis fibrosa, and multiple areas of calcification in the lungs, brain, pancreas, and pineal body.

Though the findings supported the diagnosis of renal osteitis fibrosa cystica, a diagnosis of primary hyperparathyroidism or one of coincident primary hyperparathyroidism and chronic nephritis is, as the authors state, equally tenable. This illustrates the difficulty of differentiation and the close resemblance of primary and secondary hyperparathyroidism in the end stages. STEPHEN N. TAGER, M.D.

Arytenoid Extrusion with Roentgenological Studies. William C. Voorsanger. Am. Rev. Tuberc. **46:** 684–689, December 1942.

The literature contains little reference to the extrusion or sloughing off of any part of the bony or cartilaginous structures of the larynx as a result of tuberculosis, but this condition must happen quite often, particularly in the advanced stage of the disease. A case is reported in which, by means of tomographic studies, it was possible to demonstrate the absence of one arytenoid after the patient had coughed up a mass of bone. The patient had been treated for pulmonary tuberculosis and later had displayed symptoms of laryngeal involvement necessitating tracheotomy. Following extrusion of the arytenoid the symptoms of laryngeal obstruction were greatly relieved. The author recommends oblique tomograms for study of the larynx and believes that the interpretation of small structural changes can be more readily made than from anteroposterior views. L. W. PAUL, M.D.

THE CHEST

Postpneumonic Empyema in Infants and Children; Treatment by Open Drainage: Thirty-Nine Cases, One Death. M. H. Williams. J. Thoracic Surg. **12:** 160–185, December 1942.

Although empyema has been until lately almost the

only surgical disease of the chest, its treatment still remains highly controversial. The author reports on 39 cases treated, with a single death, which was due to pulmonary embolism. Supportive measures in the preoperative period are important and consist in administration of the sulfa drugs, oxygen, blood transfusions, and parenteral fluids. Aspiration was always done, but gave little relief of sepsis. It did, however, relieve dyspnea when present.

Instead of waiting for the pus to become thick, the surgeon operated after the lapse of a definite period of time as measured from the beginning of the illness. This time interval should be within three weeks after the onset of the pneumonia and usually not before the seventeenth day. The size of the empyema is determined by putting air and lipiodol (2–5 c.c.) into the cavity and taking anteroposterior and lateral roentgenograms in the upright position. A rib corresponding to the lowest part of the cavity is resected but never lower than the 9th rib. A long thoracotomy is done and 2 to 3 1/2 inches of rib removed. Drainage tubes are not used, but to prevent sealing of the wound a rubber dam drain may be necessary. The wound is left wide open and no attempt made to keep it airtight. The cavity now remains free of pus at all times, and healing invariably occurs.

The procedure described has not resulted in a single instance of chronicity in the acute empyemas treated and has been uniformly successful in the cure of those first seen in a chronic stage.

HAROLD O. PETERSON, M.D.

Bronchial Obstruction and Pulmonary Atelectasis, as Seen in Childhood Tuberculosis with Secondary Bronchiectasis as Sequela. E. M. Kent. Am. Rev. Tuberc. **46:** 524–531, November 1942.

The incidence of pulmonary atelectasis during the course of childhood tuberculosis has been recognized in recent years, and there are those who are convinced that the massive roentgenographic shadow, commonly diagnosed as epituberculous pneumonia, is in reality an atelectasis which may involve an entire lung, one or more lobes, or a part of any lobe. The author reports the results of a study of 10 cases in which pulmonary atelectasis was present in patients with childhood tuberculosis. The study was made in an effort to determine whether bronchiectasis can be shown to be a sequel of pulmonary atelectasis occurring in the course of this disease and to add evidence to the contention that pulmonary atelectasis does occur during childhood tuberculosis and that such cases represent clinical pictures commonly but erroneously considered to have been instances of epituberculous pneumonia.

Of the 10 cases there were 7 which showed bronchiectatic changes later on in the course of the disease as demonstrated by subsequent bronchography. When the atelectasis was confined to a lobe, the patients were not particularly ill as a result of the bronchial occlusion, indicating that there had been relatively little infection in the affected areas of the lung. No appreciable shift of the mediastinum and its contents could be demonstrated when the atelectasis was limited to a lobe; this was evident only when an entire lung became atelectatic. The evidence seems to indicate that the atelectasis was secondary to extrinsic compression of the bronchi by enlarged lymph nodes rather than due to intrinsic bronchial disease. In a high percentage of cases the bronchiectasis was upper lobe in distribution, which suggests that tuberculosis does not play an appreciable role in the etiology of infectious bronchiectasis, which usually is of lower lobe distribution.

L. W. PAUL, M.D.

Fenestration of the First Thoracic Ribs. D. S. Kellogg and J. F. Linsman. Am. Rev. Tuberc. **46:** 574–576, November 1942.

Fenestration of the sternal ends of the first thoracic ribs is a rare anomaly which may be mistaken for cavitation within the lung parenchyma. The authors report such a case which had been previously diagnosed as pulmonary tuberculosis with cavitation. Roentgenograms of the chest revealed sharply outlined annular shadows about 1.0 cm. in diameter in each apical region near the anterior ends of the first ribs. By the use of oblique projections it could be demonstrated that these were true fenestrations in the ribs. This condition differs from bifid rib in that the defect is completely surrounded by a bony wall and hence is more likely to be confused with a pulmonary cavity.

L. W. PAUL, M.D.

Atelectasis Following Pneumonia in Children. G. M. Wyatt. Am. J. Roentgenol. **47:** 864–869, June 1942.

In a series of 135 cases of pneumonia in children, 26 cases of atelectasis were encountered. In addition to the familiar roentgenologic sign of increased density of the involved lung, which was seen in all cases, 3 other signs of atelectasis were observed These were:

(1) Displacement of the heart and mediastinum toward the area of increased density, sometimes accompanied by narrowing of the interspaces between the ribs, elevation of the diaphragm on the involved side, and emphysema of adjacent portions of the lung. These findings were observed in the postero-anterior view in 9 patients (35 per cent).

(2) Displacement and curving of an interlobar septum toward the area of increased density. This sign was observed in 24 patients, usually on the lateral film (92 per cent).

(3) Close spacing of large bronchovascular markings to form a curvilinear triangle of increased density within a lobe, with the base of the triangle at the periphery, its apex directed toward the hilum, and any curve of its sides toward the inner aspect of the triangle. This triangular intralobar shadow was observed in 6 patients (23 per cent).

In all the cases in this series the atelectasis cleared satisfactorily, but the author believes that such patients should be followed roentgenologically and, if recovery is not complete in two or three weeks, should be examined bronchoscopically to exclude the presence of a foreign body or a bronchiectasis.

Feline Virus Pneumonia and Its Possible Relation to Some Cases of Primary Atypical Pneumonia in Man. F. G. Blake, M. E. Howard, and H. Tatlock. Yale J. Biol. & Med. **15:** 139–165, December 1942.

A young farmer presented himself to the New Haven Hospital Nov. 7, 1941, complaining of weakness, headache, and fainting spells. Ten days prior to admission he contracted a mild sore throat, followed three days later by coryza. Two days before entrance, he began to have a slight non-productive cough. The clinical

course and x-ray films of the chest were those of a primary atypical pneumonia.

Two other members of the family had recently had a similar illness, and another was sick at home. In addition, 8 of 12 cats on the farm had died of a respiratory disease during October and 2 of the remaining 4 were sick with the same symptoms.

Epidemiological studies tentatively placed the infection in the family as primary atypical pneumonia of undetermined etiology. The nature of the acute respiratory infection which occurred in the family cats is more difficult to relate to known feline diseases. The infection in the animals, characterized clinically and anatomically by conjunctivitis, rhinitis, tracheitis, bronchitis, and pneumonia, without diarrhea or lesions in the intestines, would appear to fall within the category of those feline infections commonly called catarrhal distemper and not to have been the abdominal form of feline distemper or infectious gastro-enteritis.

Investigation of the etiology of the pneumonia found at autopsy in these cats has furnished evidence that the disease is due to a virus. Although the limited attempts at transmission with nasal washings from cat S2 and with the lung tissue of cat S3 were unsuccessful, and the serial passages from cat D8 only suggestive, the result obtained in the serial passages from cat S1 appears sufficiently clear cut to warrant this interpretation.

The evidence so far obtained suggests, but does not establish, the fact that the respiratory infections in the members of the family may have been caused by the same virus. ANDREW H. DOWDY, M.D.

Chronic Pulmonary Tuberculosis. H. R. Nayer and M. Pinner. Am. Rev. Tuberc. **46:** 505–523, November 1942.

Because of the extreme chronicity of pulmonary tuberculosis, it is necessary to make serial clinical and x-ray studies over periods of years in order to gain a clear conception of its natural course. When collapse therapy is used, the pattern of the disease is altered; spontaneous changes cannot be clearly seen and often pass unnoticed. The authors believed, therefore, that it would be of interest to review a group of patients carefully followed over many years in which no treatment had been given except bed-rest. For this study 102 cases were collected. All of the patients had pulmonary tuberculosis for ten years or more. The disease had been active or intermittently active during most of that period, and x-ray films going back ten years or more were available.

The majority of cases fell into two large groups: those with mainly fibroid disease and those with predominantly cavitary involvement. In the first group were included those who, throughout the major period of observation, presented roentgen evidence of confluent productive disease, either slowly progressive or stationary, without clear-cut evidence of cavitation. Many of these patients showed positive sputum, so that there were undoubtedly areas of tissue breakdown, but these were not sufficiently large to make an x-ray diagnosis of cavity possible. There were 35 patients with this type of fibroid disease. Eight cases were listed as a subgroup under the fibroid series. These were examples of bilateral, disseminated nodular disease with slow spread in an apico-caudal direction. Roentgenologically, they were classified as probable cases of chronic hematogenous tuberculosis.

At some time during observation there was x-ray evidence of cavity in 51 patients. In 24 cases there was definite disappearance, roentgenologically, of one or more cavities, which remained closed for years under observation. In 3 of these there was evidence of cavity closure by blocking. Serial x-ray films showed gradual obliteration of the cavity by the accumulation of fluid material until, ultimately, there was a dense round opacity corresponding to the former lesion. The process of complete blocking was slow and took from one to four years. In 2 of the patients the cavities reopened and subsequently were again blocked. In 5 patients cavity closure was intermittent. The cavities would disappear for varying periods of time by apparent collapse and apposition of the walls only to reopen at a later date.

One of the feared dangers in pulmonary tuberculosis is the spread of disease from an active focus through the bronchi to uninvolved portions of the lung. Yet in 12 patients of the group studied, the disease remained unilateral for periods of many years, even though the sputum was positive for tubercle bacilli. During healing of the tuberculous lesions there usually developed a varying amount of fibrosis and distortion of surrounding structures. In extensive lesions, particularly of the cavitary type, the process of healing caused extensive fibrosis and associated shrinkage and distortion of large parts of the lung, with similar mediastinal distortion and retraction. This is a slow process. Bronchiectasis may occur in the area of fibrosis, and, as has been noted before, bronchiectasis of the upper lobe is, in the majority of cases, the result of healed tuberculosis. Such bronchiectasis may produce no symptoms, but when infection is present, cough with expectoration of large amounts of sputum dominates the clinical picture. In this series there were 13 patients in whom the tuberculosis had apparently healed, but who were left with clinically significant pulmonary symptoms and pathological changes in the lung. Eight suffered from bronchiectasis and 5 from fibrosis and emphysema.

In 99 patients for whom sufficient data were available for determination of the extent of the disease at the time of the original diagnosis, the status at the end of the study was as follows: 30 with active disease, 22 quiescent, 3 apparently arrested, 8 arrested, and 30 apparently cured. From the standpoint of working capacity, almost half of the patients with healed lesions were unable to do a full day's work and 20 per cent were unable to work at all.

In summarizing, the authors emphasize the remarkable chronicity of the disease, the frequency with which simultaneous healing and progression occurred in the same person, and the unpredictability of the process once it is well established.

L. W. PAUL, M.D.

Sarcoid and Tuberculosis: Report of Case with Autopsy. F. Ronchese. Arch. Dermat. & Syph. **46:** 860–871, December 1942.

Multiple benign cutaneous sarcoid (Boeck's sarcoid) is believed by the author to be a separate clinical entity. Histologically, however, it may be indistinguishable from other forms of tuberculosis of the skin. Similarly, in roentgenograms of the chest sarcoid and tuberculosis cannot be consistently differentiated.

The author describes a case of sarcoid and tuber-

culosis which was proved by autopsy. The patient, a fifteen-year-old mentally deficient boy, was first seen in 1941 with a raised yellowish, smooth, firm lesion on his left temple about 3 cm. in diameter. Similar lesions were present on the forehead, neck, and back. A biopsy was taken, which was studied by a number of pathologists, most of whom made the diagnosis of sarcoid. A roentgenogram of the chest was made, but there was a division of opinion as to whether this showed sarcoid or tuberculosis.

The patient died April 10, 1942, and a postmortem study revealed a miliary tuberculosis of the lungs and spleen. At the time of death the skin lesions had regressed and a histologic examination showed only scar tissue.

The author does not agree with those who would make a diagnosis of sarcoidosis from a roentgenogram of the chest, and quotes Golden as saying that, "unaided, roentgenographic differentiation of pulmonary sarcoidosis from pulmonary tuberculosis is always difficult, frequently impossible." He also quotes Sanda to the effect that "care should be exercised in irradiating undiagnosed lesions in the chest, for the result of irradiating sarcoidosis is as bad as irradiating pulmonary tuberculosis."

The author favors the theory that sarcoid is an attenuated form of tuberculosis.

JOSEPH T. DANZER, M.D.

Tuberculous Tracheobronchitis. L. H. Clerf. Dis. of Chest **8:** 356–360, November 1942.

The author discusses the pathology of tuberculous tracheobronchitis adequately and devotes considerable space to the treatment of bronchostenosis occurring in such cases. The treatment still unfortunately depends upon systemic measures and possibly collapse therapy. In addition, the bronchoscopist may occasionally dilate the bronchial stricture sufficiently to prevent the retention of secretions beyond the stenosis, with infection. Numerous other procedures are suggested of a plus and minus character.

WM. H. GILLENTINE, M.D.

Bronchial Obstruction and Tracheobronchial Tuberculosis. E. B. Benedict. New England J. Med. **227:** 1013–1020, Dec. 31, 1942.

Tracheobronchial tuberculosis may assume three principal forms; ulcerative, hyperplastic, and stenotic. In this last there is scar tissue formation leading to partial or complete bronchial obstruction. Since obstruction may be due to other causes than tuberculosis, direct bronchoscopy is indicated for an exact diagnosis when obstructive signs are present. It is indicated also in the presence of positive sputum when parenchymal disease is controlled or absent, in the presence of unexplained hemorrhage, and when collapse therapy is contemplated to determine the possibility of tuberculosis in the trachea or contralateral bronchus.

Several case reports are presented to demonstrate the value and importance of bronchoscopic study. The first patient was believed to have a benign adenoma but bronchoscopy showed carcinoma. In the second case exactly the opposite occurred. The third patient had a sarcoma of the testicle removed and nine months later showed a bronchial obstruction, proved by bronchoscopy to be due to metastatic sarcoma. In a fourth case, with cough and a positive sputum of seven years' duration, there was complete collapse of the left lung. Bronchoscopy showed a tuberculous stricture of the left main bronchus, which was dilated. The fifth patient gave a history of pulmonary and laryngeal tuberculosis with positive sputum. The right lung was partially collapsed and herniated across the mid-line. Bronchoscopy showed a narrowing of the left main bronchus, which was dilated by the passage of esophageal bougies. The sixth patient had cough, positive sputum, and partial collapse of the right upper lobe. Bronchoscopy showed almost complete stenosis of the right upper lobe bronchus. Lobectomy was done, showing moderate bronchiectasis and extensive bronchial tuberculosis. The next patient complained of cough, fever, and chills. Chest films showed collapse of the right lower lobe. Bronchoscopy revealed an outcropping near the bifurcation of the lower lobe, which was shown to be tuberculous. The eighth patient had hemoptysis. A chest film suggested left upper lobe tuberculosis with bronchiectasis. Bronchoscopy, however, showed an ulcer of the right stem bronchus, which was tuberculous. The ninth patient had cough, fever, and wheezing. Left pneumothorax was repeatedly done. Roentgen examination showed complete collapse of the left lung with cavity. Bronchoscopy revealed a fungous mass obstructing the left main bronchus which proved on biopsy to be tuberculous. The tenth patient complained of cough and hemoptysis. A film of the chest showed a mass in the right hilus with cavitation. Bronchoscopy demonstrated a mass near the orifice of the right middle lobe, which was diagnosed as epidermoid carcinoma. A chest film in the next case showed complete collapse of the left upper lobe and partial collapse of the lower lobe. Bronchoscopy demonstrated multiple tubercles extending down the left main bronchus. The twelfth patient complained of headache, wheezing, fever, and drowsiness. A chest film showed collapse of the right lower and middle lobes. Bronchoscopic biopsy showed acute and chronic inflammation with necrosis and tuberculosis. The thirteenth patient had had a right phrenicectomy and two-stage thoracoplasty. Bronchoscopy showed the right main and stem bronchi studded with tubercles. The next patient complained of a wheeze and the sputum was positive. Repeated bronchoscopy showed a stricture of the left main bronchus, and pneumonectomy was performed. The last patient had a paralysis of the left vocal cord in the mid-line. Chest film showed a mass in the upper mediastinum with narrowing of the esophagus, but esophagoscopy revealed no abnormality. Bronchoscopy showed an extensive proliferating mass involving the left main bronchus, the carina, and right main bronchus, which gave evidence of tuberculosis.

JOHN B. MCANENY, M.D.

Tuberculosis in England During War. J. B. McDougall. Am. Rev. Tuberc. **46:** 677–683, December 1942.

With the outbreak of war many sanitaria in England were immediately transformed from a peace-time to a war-time basis. During the summer preceding the outbreak of hostilities, plans had been made and new buildings erected for such an event, and the staffs were prepared for the handling of medical and surgical emergencies. At some institutions patients with tuberculosis were discharged to make room for air-raid casualties

When the expected bombings failed to materialize, an effort was made to return to the normal tuberculosis service, but by this time it was evident that the organization had been seriously disrupted. Hundreds of open cases of tuberculosis were left uncared for according to peace-time standards. Only time was required for this to become evident, and by 1940 there was shown to be a pronounced increase during the winter months of pulmonary tuberculosis and of non-tuberculous pulmonary infections.

As the first step in reorganization many of the beds which had been taken over for air-raid precautions work were put back into commission for tuberculosis patients. One of the major difficulties was presented by the evacuated tuberculous persons who had gone into rural areas without adequate supervision and who had later returned to their homes.

During the Battle of Britain it became necessary again to utilize all available facilities for the care of war casualties. Because of the constant air-raids, patients had to be crowded into cellars and dungeons during the long winter nights. In addition, the staffs were busy attending air-raid casualties.

The author discusses the numerous difficulties encountered in the administration of sanitaria during these trying times. Among these, the problem of an adequate food supply was of the gravest importance. At the present time, and where space is available, institutions are growing vegetables and raising livestock, especially rabbits, with a view of becoming more and more independent of outside supplies.

The war has brought home the necessity for mass radiologic examination of the chest, although opinions differ as to the exact method to be adopted. There is a strong feeling that if mass radiology is to be successful and acceptable to the majority of the population, it should form part of a general medical examination and should not be thrust upon the public with the word tuberculosis as the only excuse for its adoption. The author believes that some progress has been made in returning to pre-war standards for the care of the tuberculous, but the records show that the number of deaths from the disease has undergone a pronounced increase and that there has been a proportionately greater increase from extra-pulmonary tuberculosis, particularly tuberculous meningitis, one of the surest indications of uncontrolled mass infection.

L. W. PAUL, M.D.

Technique in Mass Miniature Radiography. P. Kerley. Brit. J. Radiol. **15:** 346–347, December 1942.

Since the miniature film does not compare in detail with the full-sized film it is useful only for sifting cases of comparatively gross disease. A comparison of 4 × 5-inch films and 35-mm. films, made by enlarging both to the same size, shows that the larger film has no superiority in detail. The 35-mm. films are therefore more advantageous, as they are cheaper and can be produced more rapidly.

The average tuberculous lesion in adults measures from 0.5 to 1.5 cm., so it may readily be hidden by a rib. On single film exposures about 0.2 per cent of cases will be missed for this reason. Stereoscopic examinations give slightly better results.

Because the film-target distance is short in making miniature films, lesions near the anterior chest wall show up well in the postero-anterior projection, while those near the posterior wall may be indistinguishable. Since a majority of early lesions of tuberculosis are in the posterior part of the lung, it would be advantageous to use both an anteroposterior and a postero-anterior view.

SYDNEY J. HAWLEY, M.D.

Roentgen Manifestations of Adult Toxoplasmosis. L. R. Sante. Am. J. Roentgenol. **47:** 825–829, June 1942.

Pinkerton and Henderson recently reported two proved cases of toxoplasmosis in adults. The author reviews these two cases with particular attention to the roentgenologic findings on chest examination. One of the patients was examined at a somewhat earlier stage in the development of the pulmonary manifestations than was the other.

The earlier pulmonary manifestations are essentially those of acute pulmonary congestion and edema of the lungs, with accentuation of the hilar shadows and an increase in size and number of lung markings radiating out from both hilar regions. The appearance simulates that seen in passive congestion with pulmonary edema, but without cardiac enlargement. At a more advanced stage the picture is one of conglomerate areas of infiltration crowding upon each other to give the appearance of irregular, blotchy consolidation of the lung, with greatest involvement in the lower lobes. At this stage the roentgen appearance is similar to that of any of the atypical pneumonias or to the mycotic infections. This similarity is readily explained by the microscopic findings at autopsy, which show the process to be essentially an acute interstitial pneumonitis with associated pulmonary congestion and edema, quite similar to that seen in influenzal or virus pneumonia.

Attention is called to recent investigations of the etiology of the atypical pneumonias.

HOBART H. WRIGHT, M.D.

Some Considerations Concerning the Roentgen Diagnosis of Pneumoconiosis and Silicosis. E. P. Pendergrass. Am. J. Roentgenol. **48:** 571–594, November 1942.

Silicosis is a form of pneumoconiosis which is thought to be due to the specific action upon the lung tissue of chemically free silicon dioxide in finely divided form, producing changes that can be demonstrated in many instances on a roentgenogram. It is probable that all dusts, with the exception of chrome, free silica, and certain silicates, produce few changes in the lung that can be recognized with assurance on the roentgenogram. It is generally accepted that the protective mechanisms of the respiratory tract will exclude most of the particulate matter greater than 10 microns in diameter and that the smaller silicate particles, up to 2.5 microns, are more likely to produce lung damage than are the larger particles.

The roentgen aspects are discussed under the headings "Simple Silicosis" and "Silicosis with Infection." The characteristic lesion in silicosis is a circumscribed nodule of hyaline fibrosis. Unless such nodulation is demonstrated, a presumptive diagnosis of silicosis should be made with caution if based only on apparent exaggeration of the trunk shadows and linear markings in the lung field. The nodules are small, discrete, and multiple, varying from 2 to 6 mm. in diameter, and are more or less uniform in size and density. The shadows produced by these nodules are not always characteristic and at times resemble closely the changes seen in miliary and other types of tuberculosis and generalized meta-

static cancer. It is usually impossible to demonstrate a slowly progressive increase in size of the nodular shadows in serial films made at yearly intervals. Thus, the roentgenograms of a given patient may be regarded as negative for several years; the following year the shadows of nodules may become visible, and roentgenograms made in the succeeding year may fail to show any further increase in size. Generalized nodulation is often present with little if any clinical evidence of disability. This stage of silicosis appears to be associated with a definite increase in susceptibility to tuberculosis.

Another lesion generally included under the classification of simple silicosis is the small conglomerate lesion. This may result from a combination or coalescence of discrete nodules, or may occur primarily. The shadows are usually found in the upper half of the lung field and are difficult to evaluate in single examination.

In the group designated as "Silicosis with Infection" are included all cases of silicosis with detectable evidence of infection. In addition to the changes seen in simple silicosis, other lesions may be found, including cavities of tuberculous origin, cavities occurring as a result of necrosis of anemic infarcts, massive lesions, mottling, soft nodulation, various degrees of emphysema and bleb formation, pleural thickening, pleural collections, pneumothoraces, and deformations of the domes of the diaphragm. The roentgenologist is rarely able to predict whether the infection is due to the tubercle bacillus or some other organism, but in the majority of instances the superimposed infection is likely to be tuberculosis. The massive shadows that may be found vary greatly in size and shape. They are due usually to extensive areas of fibrosis and are found in the upper third or upper two-thirds of the lung field. While formerly it was thought that such lesions were due to silicosis with infection, in recent years some have questioned this. The extent of the massive density with respect to the periphery of the lung may be of some importance in determining whether active infection is present or not. If a lesion can be demonstrated to extend to an interlobar fissure or to the thoracic wall, it is regarded as the seat of an active infection, while if it is situated in the center of the affected lobe, the roentgen evidence is not necessarily in favor of an active infection. The author emphasizes that a final answer cannot always be given purely from roentgenologic study.

L. W. PAUL, M.D.

Bagassosis, Further Notes of Four Cases. J. A Gillison and F. Taylor. Brit. M. J. **2:** 577–578, Nov. 14, 1942.

The authors refer to a previous article on bagassosis (Castleden, L. I. M., and Hamilton-Paterson, J. L.: Brit. M. J. **2:** 478–480, Oct. 4, 1942. Abst. in Radiology **40:** 618, 1943) and add their comments on the findings in 4 cases, 2 of which were discussed by the earlier writers. The following details are emphasized:

All cases show approximately the same incubation period following inhalation of bagasse, the time being two to four months. The onset is acute and sudden. A violent cough is present for several days and the sputum is green-blue and dirty, with a foul odor. Retrosternal pain is frequent and great weakness occurs, followed by mental depression. X-ray changes were present in only one case and these were not typical. Bronchoscopic findings were vague. Congestion, frothy mucus, and various bacilli were manifest.

In conclusion the authors point out the difficulty in classifying this condition industrially, as the end-results differ considerably and the diagnostic criteria are vague.

Q. B. CORAY, M.D.

Thoracic Gastric Cysts: Report of Two Cases with a Review of the Literature. Henry Schwarz II and Charles S. Williams. J. Thoracic Surg. **12:** 117–130, December 1942.

The authors present two case reports of thoracic gastric cysts and review the literature on this subject. There have been only 10 cases reported previously. These cysts are all located in the posterior mediastinum and in general project into the right chest. Most of the patients are less than one and one-half years of age but one example was encountered at twenty-three years of age. There are two types, based on the functional activity of the gastric mucosa in the cysts. In 5 of the cases the mucosa was actively secreting and this, in the presence of a draining sinus, made possible a correct preoperative diagnosis, since hydrochloric acid was present and the material from the cyst digested egg albumen and produced excoriation of the skin. In 7 of the cases gastric mucosa was present but there was no evidence of gastric secretion. Muscular coats are also present in all cases, in varying amount.

An elaborate embryologic explanation for the origin of these tumors has been suggested. The authors emphasize that they are not dermoids or teratomas and that the presence of a dermoid in the posterior mediastinum has never been adequately proved.

HAROLD O. PETERSON, M.D.

Method for Rapid, Repeated, Approximate Determinations of the Transverse Diameter of the Heart. S. Waldman. J. Lab. & Clin. Med. **28:** 201–204, November 1942.

Repeated and fairly accurate determinations of the transverse diameter of the heart can be done inexpensively by a simple attachment to the fluoroscopic screen. A strip of clear x-ray film is marked off at intervals of 0.5 cm. with radiopaque ink and is inserted into the base of the screen. The widest cardiac diameter is determined by raising and lowering the screen to project the heart on the full width of the strip. The proximity of the fluoroscopic tube to the chest causes divergencies which preclude the use of figures gained by this method for comparison with tables developed from the teleoradiogram. By the same token changes in the size of the heart tend to be exaggerated and therefore more easily determined.

DONALD R. LAING, M.D.

Complete Situs Inversus: Report of a Case with Calcareous Aortic Stenosis and Cor Bovinum. J. G. Pasternack. New England J. Med. **227:** 953–954, Dec. 17, 1942.

This is believed to be the first case report of complete situs inversus with calcareous aortic stenosis, cor bovinum, and multiple pulmonary infarcts. The patient, known to have dextrocardia, was seen in cardiac decompensation. Physical examination and an electrocardiogram sustained the diagnosis of dextrocardia. Roentgenogram of the chest showed the maximum right

heart measurements to be 10.8 cm. to the right and 7 cm. to the left, with a transverse chest diameter of 28.4 cm. Lateral views suggested aortic calcification. Barium meal studies showed situs inversus of the gastro-intestinal tract.

Autopsy confirmed these findings, showing complete situs inversus with aortic stenosis, cor bovinum, and multiple pulmonary infarcts.

JOHN B. MCANENY, M.D.

THE DIGESTIVE TRACT

Radiologic Examination of an Esophageal Spasm May Lead to Error in Localization of the Lesion Causing It. F. Naville and R. Herrmann. Schweiz. med. Wchnschr. **72:** 1224–1227, Oct. 31, 1942.

The study of esophageal spasm has been a matter of no difficulty since the advent of x-ray. Such spasms may be classified into two groups, the "essential" or "idiopathic" type and the type secondary to an organic lesion of the mucosa, the neuromuscular mechanism, or the extrinsic nerves of the esophagus.

The idiopathic type may be transient, acute, or permanent. It is found only at the entrance or exit of the esophagus. In the permanent type involving the exit, secondary dilatation of the esophagus takes place. Many theories as to the cause of such spasm have been advanced, none perfectly satisfactory. The authors favor the sympathetic-parasympathetic imbalance theory.

The secondary type may be caused by any mucosal lesion, however trifling. Inflammatory lesions of the muscular wall and extrinsic sympathetic irritation may likewise lead to spasm. In the case of a mucosal lesion, the question whether the spasm is localized to the area of the lesion arises.

An illustrative case is that of a 39-year-old man who accidentally swallowed a piece of bone. Substernal pain immediately developed and persisted thereafter. Roentgen examination with an opaque meal showed spasm of the lower end of the esophagus, and after the organ was emptied for mucosal studies a niche was thought to be present here. A diagnosis of traumatic ulcer was made. The patient was subfebrile. Eight days after the accident he died of a sudden profuse hemorrhage.

Autopsy showed an area of mediastinitis in the vicinity of the left lung root, involving the left lung secondarily; there were multiple esophageal perforations 13 cm. distally from the arytenoids, and one of these to the left communicated with the abscess. The aorta was involved. The lower esophagus was perfectly normal. The bone causing the perforation was not recovered.

The authors conclude that it is not possible to localize with certainty any lesion of the esophagus on the basis of the location of demonstrated spasm. The causative lesion can be localized with certainty only by esophagoscopy unless the roentgen changes are such as to point out the primary lesion beyond all doubt.

LEWIS G. JACOBS, M.D.

Respiratory Function of the Digestive Tract as the Basis of Roentgenographic Life Test. J. G. Dillon. Am. J. Roentgenol. **48:** 613–624, November 1942.

The mechanism of the entrance of air into the stomach still remains uncertain, and the fate of air which has gained access to the stomach is unknown. It has been maintained generally that air found in the stomach has been swallowed. For various reasons the author does not believe this is possible except for very small amounts taken during the swallowing of food or other material. He is of the opinion that air in the stomach is due to suction occurring during the inspiratory phase.

There appears to be sufficient evidence to consider it well established that, as well as a pulmonary respiration, every human being has a gastric respiration, the latter being subsidiary, though in some cases it may become prevailing. It is pointed out that a roentgenogram of a stillborn infant shows a uniform density throughout the thoracic and abdominal cavity. With infants born alive and who have breathed for even a few minutes, the outlines of the heart and bronchial tree are more or less differentiated. The most important and substantial difference, however, concerns the abdominal cavity. If the infant makes even a few respiratory movements, and if the lumen of the esophagus is not blocked, a certain amount of air will be found in the stomach or intestines, and the deeper and longer the respiratory movements of the thorax, the larger the amount of air. The presence of air in the digestive tract of a newborn infant can serve as proof of extra-uterine respiration and hence as proof that the infant was born alive. Such a roentgenographic test of life is the most reliable and sensitive of all such available tests.

There also is direct proof of the possibility of using the digestive tract of a human organism as a respiratory organ. The author mentions the case of an infant, who was born alive and lived twenty-five minutes and was examined roentgenologically shortly after its death. On the roentgenogram it was impossible to distinguish the heart from the lungs, which indicated their atelectatic state. At the same time, the stomach and intestines contained air. Postmortem examination showed a congenital atelectasis of the lungs. Other cases of similar nature have been reported.

The author is uncertain as to the role such gastro-intestinal respiration may play in adults. It is possible that it has some significance in certain pathological states when the respiration of the lungs is affected. In the infant such gastro-intestinal respiration appears to be a regular subsidiary gaseous exchange which begins to function during any disturbance or stoppage of the pulmonary respiration. L. W. PAUL, M.D.

Correlation of Roentgen Ray Diagnosis of Lesions of the Stomach and Duodenum with the Operative Findings and Selected Case Reports. W. James Marquis and C. F. Baker. J. Med. Soc. New Jersey **39:** 575–580, November 1942.

Two hundred cases have been reviewed, with subsequent operative findings. The roentgen findings are classed as (*a*) miscellaneous, 7; (*b*) gastric ulcer, 12; (*c*) gastric carcinoma, 14; (*d*) gastro-enterostomy, 20; (*e*) duodenal ulcer, 53; (*f*) normal, 94.

Of the 7 miscellaneous cases, 2 were incorrectly diagnosed: one was not identified, and in the other the operative findings were not conclusive. Roentgen diagnosis in the latter case was "adhesions about the pyloric area." At operation adhesions were found, and biopsy revealed carcinoma; a primary lesion was believed to be located in the pylorus.

There was, too, one error of commission in which roentgen diagnosis of ulcer was made, and none was found at operation.

Among the carcinoma diagnoses, one frank error of commission was made. This was a roentgen diagnosis of carcinoma on the greater curvature, which was found upon operation to be normal.

In the gastro-enterostomy group 3 cases of gastrojejunal ulcer were diagnosed roentgenologically and found at operation. In 4 cases, a diagnosis of obstruction, either at the stoma or in the duodenum, was confirmed by later operative findings.

Among 53 cases of duodenal ulcer, there was a frank disagreement in 2 instances, and in 4 other cases the roentgen diagnosis was questionable. Of the 4 patients, 2 were found to be normal and 2 had carcinoma. In 82.5 per cent of this group the roentgen and operative findings were in full agreement.

Finally, of the 94 cases diagnosed as normal, there were 2 in which there was frank disagreement. One patient had a carcinoma at the cardiac end of the stomach, not recognized at the roentgen examination, but which was present at operation six months later. One case turned out to be a ruptured gastric ulcer.

The greatest number of errors occurred in the group that was diagnosed as duodenal ulcer.

The authors refer to similar statistical reports prepared by E. B. Harding in 1929 (Am. J. Roentgenol. **22:** 36–42, 1929) and Sarah M. Jordan in 1941 (J. A. M. A. **116:** 586–590, 1941). In their own series they do not include the films of the questionable cases, which might have been helpful to other radiologists. This detracts seriously from the value of the study.

STEPHEN N. TAGER, M.D.

Critical Analysis of 938 Gastroscopic Examinations. R. J. F. Renshaw and George E. Clark. Am. J. Digest. Dis. **9:** 401–404, December 1942.

An analysis of gastroscopic studies of 842 patients was made in an effort to determine the value of the procedure. In 217 patients, or 25.6 per cent of the total, gastroscopy was thought to have been of major value. In this group it revealed the true diagnosis when all other examinations were negative or indeterminate. In 556 cases, or 55.4 per cent, gastroscopic observations were of minor value and the findings were such that they did not alter the major diagnosis.

Under the heading "Major Limitations," the authors state that in 160 cases, or 19 per cent, gastroscopy was of no value, the failure being due in many cases to inability to see the area in question The blind areas, "are probably larger than most gastroscopists or clinicians realize." Other causes of failure include anatomical difficulties, spasm of the esophagus, and poor co-operation of the patient.

In order to compare the efficacy of gastroscopy and of x-ray study, 170 cases were chosen. There was agreement in the diagnoses in 109 cases; both methods were wrong in 9 cases, and both were indeterminate in 14 cases. The roentgenologic examination was correct and gastroscopy indeterminate in 15 cases, while gastroscopy was correct and roentgenoscopy indeterminate in 23 cases.

The authors believe that the methods are complemental or supplemental and that both may be required to make a diagnosis.

JOSEPH T. DANZER, M.D.

Analysis of Relationship of Surgery and Gastroscopy in 95 Cases of Gastric Tumor. R. Schindler and P. Letendre. Surg., Gynec. & Obst. **75:** 547–557, November 1942.

A series of 95 cases of gastric tumors is presented. In all patients both gastroscopic and x-ray examinations were made and these are evaluated in the light of later surgical or pathological diagnosis, with attention to the gastroscopic aspects of the series.

Gastroscopic failures—in which the tumor was not seen—occurred 5 times. In 3 instances the tumors were in the "blind areas" of the stomach. The other two cases were annular carcinomas of the pylorus, in which the lumen closed with peristalsis and gave the gastroscopist the impression of viewing the normal pylorus.

In 5 cases gastroscopic diagnosis was wrong. Errors consisted of calling carcinomas benign ulcers, confusing gastritis with carcinoma, and sarcoma with polyposis.

Indefinite gastroscopic diagnosis appeared 4 times. An indefinite diagnosis is defined as "one in which the gastroscopist refused to commit himself definitely but admitted that he was unable to make a differential diagnosis."

The x-ray aspects of the series are not discussed in detail. Of 91 gastric carcinomas, 8 escaped x-ray observation at the first examination and in 7 cases a wrong diagnosis was made. This gave a total of 15 failures as compared with 10 gastroscopic failures. It is emphasized that there should be close co-operation between gastroscopy and roentgenography, the latter remaining the standard method for the diagnosis of gastric carcinoma.

Proper gastroscopic orientation and study will reveal the size and site of the tumor—of great importance to the surgeon. Gastroscopy was in some cases superior to palpation and inspection in this respect.

The gross type of tumor may be diagnosed at gastroscopy but caution should be exercised, for the entire lesion must be seen before an opinion is rendered.

IVAN J. MILLER, M.D

Incidence of Malignancy in Prepyloric Ulcers. B. R. Kirklin and W. C. MacCarty, Jr. J. A. M. A. **120:** 733–735, Nov. 7, 1942.

The incidence of cancer in gastric ulcers near the pylorus, long assumed to be disproportionately higher than that of ulcers situated elsewhere in the stomach, has become in recent years an open question.

The authors reviewed all cases for a five-year period (1937–41) in which the roentgenologic diagnosis at the Mayo Clinic was prepyloric ulcer, ulcerating or obstructing lesion at the pylorus, or duodenal ulcer. Cases in which carcinoma had been diagnosed definitely as such were not included. Only those cases proved surgically and pathologically were accepted for study, and only those lesions which were confined to the 3 cm. of the stomach immediately proximal to the pyloric ring or that appeared to have originated in this segment were considered to be prepyloric. The series comprises 190 cases.

There were 47 cases in which the examiner discerned a niche-producing lesion which appeared to be purely ulcerous, without tumefaction or other indication of malignant growth and in which the roentgen diagnosis accordingly was ulcer, implying that the lesion was benign, although malignancy could not be positively excluded. At operation and pathologic examination a

benign prepyloric ulcer was found in 34 instances and a malignant prepyloric ulcer in 5 instances. In the remaining 8 cases the lesion proved to be ulcerating carcinoma in 3 and ulcer at the base of the duodenum in 5.

In 26 instances a diagnosis of ulcerating lesion at the pylorus was made. In 9 a benign prepyloric ulcer was found, in 2 malignant ulcer, in 10 ulcerating carcinoma, in 4 duodenal ulcer near the pylorus, and in 1 carcinoma of the pancreas. Five of the ulcerating carcinoma lesions were reported as being "probably malignant."

A diagnosis of obstructing lesion at the pylorus was returned 100 times. Benign prepyloric ulcer was found in only 9 instances, ulcerating carcinoma in 43, duodenal ulcer in 44, carcinoma of the pancreas in 3, and carcinoma of the gallbladder in 1. In 19 of the 43 ulcerating carcinomas the examiner suggested in his report that the lesion probably was malignant.

After the duodenal ulcers and the carcinoma of the gallbladder or pancreas were deducted, there remained 132 prepyloric ulcerating lesions, of which 61 were frank tumefactive carcinomas with ulceration and 71 were ulcers. Of the 71 ulcers, 63 were benign and 8 (11.3 per cent) were malignant. This percentage would indicate that prepyloric ulcers are not more likely to be carcinomatous than other gastric ulcers.

The authors feel that the conflicting statistics and conclusions of various authors on this subject probably arise from differing definitions and connotations of terms. Classification of the lesions as ulcers, malignant ulcers, and ulcerating carcinomas is of practical value and is warranted by differences in their morphologic characteristics. The term "ulcer" implies a nonmalignant peptic ulcer, the crater of which is sculptured in the gastric wall, seldom has a diameter exceeding 2.5 cm., and does not have any tumefaction of its borders. Adjacent rugae are likely to be accentuated and convergent. The designation "malignant ulcer" is restricted to a lesion that has the morphologic characteristics of benign ulcer but on microscopic examination is found to be carcinomatous. Sometimes this ulcer is unusually large and irregular, and tenderness and spastic manifestations are lacking. The term "ulcerating carcinoma" is best confined to ulcerating carcinomatous tumors in which both ulceration and tumefaction are demonstrable. In the small carcinomas with which this study deals, ulceration is a conspicuous, even dominant, element, but commonly the crater thus produced has not penetrated into the gastric wall and is entirely within the tumor, the remnant of which persists as an elevated ring around the crater. Roentgenologically the tumefied ring, when under pressure, gives rise to the meniscus sign, a translucent halo about the ulceration. The pseudoniche does not project beyond the normal limit of the gastric lumen, the lesion is not tender to pressure, and rugae adjoining it are subdued or effaced.

If the foregoing distinctions were applied uniformly in all studies of the incidence of malignant change in gastric ulcers, the results should not be widely different. There can be little doubt that the conflicting data and opinions now current are due to differing conceptions of benign ulcers, malignant ulcers, and ulcerating carcinomas. If all prepyloric ulcerous lesions, regardless of size, degree of penetration, and the presence or absence of visible tumefaction, are to be considered ulcers, then an overwhelming majority of them are indisputably malignant.

Among all prepyloric lesions, regardless of their morphologic variety, 4 out of 5 are malignant. For the roentgenologist, there will remain many small prepyloric lesions, as well as a few ulcers in the base of the duodenum, that he cannot diagnose specifically, and since a majority will prove to be carcinomatous, his report should be made in terms that will put the clinician on guard. It is emphasized that of much greater importance than the exact incidence of malignant change in prepyloric ulcers, as strictly defined, is the fact that a large majority of the lesions in this part of the stomach are ulcerous and malignant.

CLARENCE E. WEAVER, M.D.

Benign Tumors of the Stomach. G. S. Dudley, L. Miscall, and S. F. Morse. Arch. Surg. **45:** 702–726, November 1942.

The incidence of benign gastric tumors seems much greater than is generally believed. Autopsy series from several sources including Bellevue Hospital, New York, from which this report comes, show that about one-fourth of all gastric tumors are benign. Surgical series show an incidence of only 1.3 per cent, a discrepancy probably due to the fact that the benign tumors seldom give sufficient symptoms to warrant operation.

The authors found records of 76 benign gastric tumors (from 21,026 autopsies) which were subjected to microscopic study. Sixty of these patients had had adequate hospital observation, but in no case was the correct diagnosis made. In 42 instances the patient was asymptomatic and roentgen studies of the stomach were devoid of positive findings. Vague and confusing symptoms were present in 18 cases. Ulceration of the tumor or elsewhere in the stomach or duodenum was present in 15 per cent of the cases. About a fourth of the mucous polyps had undergone malignant change. Gastritis was frequently present. No clearly characteristic symptoms were observed.

The pylorus was the most frequent site (47 per cent of cases) with the pars media following closely (39 per cent); in 14 per cent the cardia was involved. Diffuse tumors were also observed. Polyps, fibromas, myomas, and adenomas occurred in descending order of frequency; one fibrolipoma was noted.

Bleeding or strangulation may lead to an alarming picture; confusion with bleeding ulcer or carcinoma is frequent. Treatment by local excision is advocated for all these tumors. LEWIS G. JACOBS, M.D.

Long Survival after Gastrectomy. C. A. Joll and D. L. Adler. Brit. M. J. **2:** 632–635, Nov. 28, 1942.

The authors call attention, in the opening paragraph of their paper, to the few total gastrectomies performed in either England or the United States. The operation is defined as total removal of the stomach, with anastomosis between the pylorus and the esophagus.

The history of the procedure is reviewed and it is apparent that in the initial performances of this operation the mortality was extremely high. The present-day technic, however, has brought about considerable improvement. The principal difficulty has always been the overcoming of perigastric adhesions to a sufficient degree to allow the approximation of the pylorus and the esophagus.

Justification for the operation demands that disease

be limited to the stomach or adjacent tissues. The prognosis is discussed and various series referred to which show a considerable variation in mortality rates. The most common cause of postoperative death is surgical shock rather than faulty technic. The resulting achlorhydria is not to be feared. Most patients have good appetites and may return to work, leading a normal existence.

Two case histories are presented, the patients in each instance having survived the operation over three years. Q. B. CORAY, M.D.

Lymphosarcoma of the Intestine: Report of Two Cases. F. R. Menne, D. G. Mason, and R. Johnston. Arch. Surg. **45:** 945–956, December 1942.

Among tumors occurring in relatively uncommon sites, those of the small intestine usually produce vague and indefinite symptoms. Lymphosarcoma is the most common of the small intestinal tumors. The authors found record of only 2 cases in some 50,000 observations. The cause is unknown, and the disease is most common in the third, fourth, and fifth decades. No sex preference is noted in the literature. The ileum and duodenum are most commonly affected. The growths tend to become lobulated and expand into the intestinal lumen. Ulceration occurs late: metastases, either by the blood or lymph stream, may be early and striking.

Symptoms tend to be atypical and are those of an incomplete obstruction, with tenderness, pain, tympanites, nausea, and vomiting finally. Speese (Ann. Surg. **59:** 727, 1914) classifies the symptoms as (1) latent, tumor discovered at autopsy; (2) general, with distention or a mass first noted; (3) acute surgical, with intussusception, perforation, or obstruction; (4) resembling tuberculous peritonitis; (5) with jaundice as the first symptom; (6) resembling ovarian cysts; (7) simulating appendicitis. The chief complaints are abdominal pain, vomiting, constipation, and loss of weight. Melena is usually absent. A mass can often be palpated. Roentgen examination generally reveals a residuum in the loops of the ileum, rigidity of the ileocecal valve, a filling defect of the cecum, and distention and obstruction of the small intestine. Partial stenosis with dilatation is one of the common characteristics. Early radical removal offers the only hope of cure, but the prognosis is usually grave.

Two cases are reported rather fully. One of the patients died of metastasis four months after operation; one is alive and well after three years.

LEWIS G. JACOBS, M.D.

THE BILIARY TRACT

Intrinsic Disease of the Liver Simulating Acute Cholecystitis. K. B. Lawrence and H. M. Clute. New England J. Med. **227:** 701–705, Nov. 5, 1942.

With the present tendency for immediate operation in acute cholecystitis insufficient time is often taken for complete study of the patient to eliminate some other condition difficult or even impossible of differentiation. This paper deals with several cases that have been confused with acute cholecystitis.

The usual picture of acute cholecystitis is local colicky pain, acute or subacute, radiation to the right scapula, nausea, and vomiting. Later the gallbladder is distended and may be palpable. The pain changes to an intense dull ache. There is a slight rise in temperature, pulse rate, and leukocyte count.

The various entities that must be considered in a differentiation are: (1) necrosis of a tumor, causing irritation of the liver surface; (2) stretching of Glisson's capsule over an hemangioma, abscess, or echinococcus cyst of the liver; (3) a diffuse hepatic inflammation, as in acute hepatitis or yellow atrophy.

A case report is included of a patient who was known to have carcinoma of the rectum and presented the signs of acute cholecystitis; at operation a metastatic nodule was found close to the gallbladder bed. Another patient, who had had a malignant polyp removed from the colon, was considered to have acute cholecystitis but in view of the history of malignant disease was not operated upon. She died of generalized carcinomatosis. A third patient thought to have acute cholecystitis was found at operation to have a primary hepatoma. A fourth case was that of a 36-year-old Negro who had inhaled fumes from a broken fire-extinguisher. Liver biopsy at operation showed an acute hepatic necrosis (central type). JOHN B. MCANENY, M.D.

Varices of the Gallbladder: Associated with a Mucosal Cyst. M. Feldman and J. E. Goodman. Am. J. Digest. Dis. **9:** 399–400, December 1942.

A case of varices of the gallbladder associated with a simple mucosal cyst is described.

A simple mucosal cyst gives the characteristic roentgen picture of a benign tumor. The author states that varices should be considered when there are, "(1) symmetrical marginal constrictive defects and (2) varying densities of the cholecystographic shadow, with intervening negative areas corresponding to the course of the veins." JOSEPH T. DANZER, M.D.

Cholangiographic Artifacts Resembling Common-Duct Stones. H. M. Clute and K. B. Lawrence. New England J. Med. **227:** 727–730, Nov. 12, 1942.

The practice of draining the common bile duct with a T-tube following exploration brings up the question as to when the patency of the duct and the absence of residual calculi are sufficiently assured to warrant removal of the tube. One practice has been to clamp off the tube for several days to see if the duct were open. Even with this procedure an occasional stone is overlooked.

A more recent development is cholangiography, in which an opaque substance is injected into the tube under fluoroscopic control and roentgenograms are made to determine the condition and patency of the common duct. Normally there should be filling or partial filling of the biliary duct system, and passage of the opaque medium into the duodenum. Abnormally there is dilatation of the biliary duct system, the presence of shadows indicative of a foreign body, or failure of the medium to enter the duodenum.

Shadows in the cholangiogram suggesting stones may, however, be due to artifacts. In 3 cases seen by the authors such artifacts were caused by clots of old blood, bile, and mucus attached to the lower end of the T-tube. The differentiation between a clot and a stone is made by repeated washing out of the tube and duct and repeated cholangiograms. This procedure will show sufficient change to permit one to decide that the shadow is not due to stone.

In a fourth case air bubbles gave the appearance, in the cholangiogram, of residual stones. Changes in the size and position of the defects on repeated examination suggested the actual condition.

It is only by repeated examinations of the injected tube and duct that shadows can be definitely attributed to artifacts. JOHN B. MCANENY, M.D.

THE PANCREAS

Cysts of the Pancreas. J. Rabinovitch and B. Pines. Arch. Surg. **45:** 727–746, November 1942.

The authors report 17 cases of pancreatic cyst from the records of the Jewish Hospital, Brooklyn. The condition is most common in females of middle age. Its pathogenesis is doubtful; the types seem to be covered by retention cyst, proliferative cyst (including cystic adenoma and cystic epithelioma), hydatid cyst, congenital cystic disease, hemorrhagic cyst, pseudocyst, dermoid cyst, and cyst arising from aberrant Brunner's glands. This last type has not previously been described. The most common type is the pseudocyst (11 cases), a fluid tumor in more or less close proximity to but not originating in the substance of the gland. Effusion into the lesser peritoneal sac as a result of injury to the pancreas is the most common cause of this condition.

The clinical picture is somewhat confusing, and laboratory tests are not infallible. Pain is the most important symptom; it varies from a sense of fullness to sharp cramps and is localized in various parts of the abdomen or is diffuse, having no characteristic site. In many cases in the authors' series there were nausea and vomiting. Loss of weight, constipation, diarrhea, and jaundice may occur. The average duration of symptoms was six months. On physical examination one finds a mass, often not very movable.

On roentgen examination an enlarged duodenal loop is found in cysts of the tail, and displacement of the duodenum and small intestines in other cysts.

The picture at operation is characteristic. A smooth hemispherical fluctuant tumor is seen arising from the pancreas. On aspiration sanguineous fluid is obtained. Oil, bile, or pancreatic juices may be found. Complete removal is the treatment of choice, where possible. If the cyst is large and adherent, marsupialization is preferable. Prognosis is good if malignant change has not occurred.

The 17 case reports include one in which a cyst arising in remnants of aberrant Brunner's glands is described. LEWIS G. JACOBS, M.D.

THE SKELETAL SYSTEM

Hurler-Pfaundler Syndrome (Gargoylism): Review of the Literature with Report of an Additional Case. R. M. Harvey. Am. J. Roentgenol. **48:** 732–740, December 1942.

Since Hurler's original report of the syndrome bearing her name and that of her associate Pfaundler, 35 additional cases have appeared in the literature. These, together with the case reported by the author, bring the total of published examples to 38.

Clinically the head appears to sit on the shoulders of a short trunk, while the extremities, although shortened, are not so short proportionately as the trunk. The skull is invariably enlarged and usually is scaphocephalic. The frontal and temporal bones are usually prominent and there is a marked supraorbital ridge. The bridge of the nose is sunken and the eyes are set wide apart. The outstanding feature of the disease is a bilateral milky clouding of the deeper corneal layers which, strangely enough, does not cause any serious disturbance of vision. There is an acutely angled kyphosis of the spine, centered at the level of the twelfth dorsal or first lumbar vertebra. The extremities, as a rule, are maintained in slight flexion. The hands are claw-shaped. Genu valgum is a constant finding. The clavicles are enlarged. The abdomen is greatly enlarged and pendulous. Enlargement of the liver and spleen is almost always present. Mental retardation is a cardinal feature of the disease. The cases recorded are divided almost equally between the sexes.

In the roentgenogram the sella turcica is seen to be elongated and shallow. Prominence of the vascular markings in the frontal area is often present. Poor development of the frontal sinuses and mastoid cells has been reported. The clavicles are frequently thicker than normal, especially at their sternal ends. The ribs vary greatly in size and shape. At the site of the kyphosis the affected vertebral bodies are small and show definite loss of substance in their upper anterior portions. All the extremities show serious growth disturbance, more prominent in the upper than in the lower extremities. The epiphyses have a fragmented distorted appearance. Ossification is retarded. The distal phalanges are small and pointed. The hip joints show a coxa valga deformity.

The skeletal changes are a form of chondrodystrophy and have been considered as due to a defect in the germ plasm. The mental retardation, corneal clouding, hepatosplenomegaly, and other non-skeletal deformities have been proved to be due to a disturbance in lipoid metabolism, related to the great group of lipoidoses which includes Niemann-Pick's disease, Gaucher's disease, xanthomatosis, and familial amaurotic idiocy. The occurrence of 12 cases in siblings shows the strong familial tendency, although no hereditary disposition has been noted.

In 4 postmortem examinations, microscopic examination of the brain tissue showed granular deposition of lipoid material in the ganglion cells. Berliner (Arch. Opth. **22:** 97-105, 1939) found these same lipoid deposits in the liver, spleen, lymph nodes, anterior lobe of the pituitary gland, and in the corneas.

In diagnosis, the condition causing the greatest confusion is the chondrodystrophy bearing the name of Morquio (Bull. Soc. de pédiat. de Paris **27:** 145–152, 1929). Morquio's cases showed no corneal clouding, no mental retardation, and no changes in the skull or facial bones. The joints in Morquio's disease are lax and motion is not restricted as in gargoylism. Most patients with Morquio's disease have a coxa vara deformity in contrast to the valgo-deformity of gargoylism. The changes in the long bones are practically identical in the two conditions. There is more involvement of the vertebrae in Morquio's disease.

There is no known cure for gargoylism. The course is usually progressive. The oldest patient that has been described was nineteen years of age and the two next oldest were each eighteen.

The author's patient was a boy aged 5 1/2 years. Photographs and roentgenograms illustrating the characteristic changes set forth in his description of the disease are included. CLARENCE E. WEAVER, M.D.

Chronic Sub-periosteal Abscess. J. F. Brailsford. Brit. J. Radiol. **15:** 313–317, November 1942.

The outstanding clinical symptom of chronic subperiosteal abscess is pain in the affected extremity, varying greatly in severity. There may or may not be fever; there is usually no superficial evidence of inflammation; there may or may not be a history of trauma.

The roentgen ray appearance is of a spindle-shaped thickening of the cortex of one part of the circumference of a bone, with great increase in density. In well developed cases, especially with over-penetrated technic, a small area of translucency may be seen. If serial studies are made, the thickened area will be seen to develop gradually from a slight periosteal elevation.

Differentiation from gumma and Brodie's abscess must be made. The lesions are sometimes incorrectly diagnosed as sclerosing osteomyelitis. In the early stages they may be confused with osteogenic sarcoma.

The treatment is surgical removal. On opening the involved area a small amount of pus is usually found in the central area of translucency. Six cases are presented, one of which probably is a gumma. Three of the remaining five were of staphylococcic origin. The other two were not operated upon.

SYDNEY J. HAWLEY, M.D.

Obturator Sign as the Earliest Roentgenographic Sign in the Diagnosis of Septic Arthritis and Tuberculosis of the Hip. H. W. Hefke and V. C. Turner. J. Bone & Joint Surg. **24:** 857–869, October 1942.

In the normal anteroposterior roentgenogram a soft-tissue shadow is seen along the brim of the true pelvis. It begins just lateral to and below the inferior pole of the sacro-iliac joint and extends forward, disappearing behind the upper ramus of the pubis. Normally this shadow in children measures from 2 to 8 mm. at its greatest width and is the same on both sides, except for possible minimal difference in breadth. Certain significant changes occur in its contour in septic arthritis and tuberculosis of the hip.

The shadow is believed by the authors to be due to the obturator internus muscle, and changes in its character are designated as the obturator sign. While no autopsy material is available to determine the condition of the muscle when casting a widened shadow, it is believed that the increased width is due to edema in early cases, and possibly to calcification in late cases.

The sign is graded from 1 to 4. Grade 2 is twice the normal width and grade 4, more than four times the normal width. Grades 1 and 3 are placed correspondingly. Usually the shadow on the opposite side may be taken as normal. Occasionally the border of the muscle is obscured or hazy, and this, also, indicates hip-joint disease. The changes here resemble the psoas muscle changes seen in certain inflammatory conditions.

Technically the routine pelvic view is sufficient for demonstrating the obturator shadow, but occasionally the "frog position" is of advantage. Both extremities must be in the same relative position and the pelvis flat.

Twenty-three proved cases of septic arthritis of the hip varying in duration were examined. Of six patients studied the first week after the onset of symptoms, 3 gave a positive obturator sign (1 Grade 2, 2 Grade 1); none showed bone change; 1 showed joint change. Of 16 patients seen in the first two weeks (including the 6 of the first week) all but one (94 per cent) showed positive obturator signs (3 Grade 1; 7 Grade 2; 1 Grade 3; 2 Grade 4). Of this group, 19 per cent showed bone changes and 25 per cent joint changes. Seven other patients were examined between the second and seventh weeks and 6 of these showed positive obturator signs. The 2 patients of the series that failed at any time to show the positive sign are accounted for by death and early incision and drainage.

On the basis of these cases, it may be said that by the end of two weeks this sign enables one to make a positive diagnosis of hip joint disease in 94 per cent of cases, whereas bone change is demonstrable in only 25 per cent at this time. The sign holds true in adults as well as in children, although adults are not included in this study.

Of 17 cases of tuberculous coxitis, 8 were seen in the first three months and 90 per cent of this number showed bone changes, while only 66 per cent showed obturator changes and only 55 per cent joint changes. In 15 patients seen in the first 12 months 100 per cent showed bone changes, 80 per cent showed joint changes, and 73 per cent gave a positive obturator sign. In tuberculosis the obturator shadow is usually obscured rather than widened as in the septic hip, resembling the obscure psoas shadow in tuberculosis of the spine. It may be possible that in very early cases the obturator sign is positive before bone or joint changes, since all these cases were of months' rather than days' duration.

Perthes' disease, epiphysiolysis, rheumatic arthritis, fracture about the hip, neighboring osteomyelitis, and soft tissue infection about the hip, all failed to show a positive obturator sign. JOHN B. MCANENY, M.D.

Case Records of the Massachusetts General Hospital. Case 28481. New England J. Med. **227:** 840–844, Nov. 26, 1942.

A 17-year-old girl had several attacks of twitching and partial paralysis of the right side of her face, with hyperalgia and aching in the right ear, with loud noises. A roentgenogram of the skull showed no abnormality. The pupils reacted with hippus and there was a slight swelling over the right temporoparietal region; otherwise the examination, history, and laboratory findings gave no significant information.

Nine and a half weeks after examination the patient was again seen, with increase in the temporoparietal swelling. Films of the skull at this time showed a defect measuring 3 × 2 cm. in the right frontal bone, just anterior to the coronal suture. Six and a half weeks after this the lesion was slightly larger, but no other developments were noted.

Various conditions were considered in the diagnosis. The lesion in the calvarium was not the cause of the right-sided facial paralysis. Osteomyelitis and syphilis were eliminated because of lack of evidence. The appearance did not correspond to a bone tumor. Multiple myeloma was considered but abandoned. By elimination, the diagnosis of Hand-Schüller-Christian disease, eosinophilic-granuloma variant, was made.

Biopsy of the lesion showed a granulomatous process containing foam cells but no eosinophils, typical Hand-Schüller-Christian disease. The question of the unusually rapid appearance of the lesion was brought

up and the answer made that these lesions may develop very swiftly. JOHN B. MCANENY, M.D.

Non-Traumatic Occipito-Atlanto-Axial Dislocation. O. Englander. Brit. J. Radiol. **15:** 341–345, December 1942.

Three types of dislocation, other than fracture-dislocation, may be observed in the region of the first two cervical vertebrae: (1) forward dislocation of the atlas on the axis, (2) atlanto-axial rotation, (3) occipito-atlantoid dislocation. Although rare, these may follow (1) any inflammatory process in the neck, (2) tuberculosis, syphilis, osteomyelitis, rheumatic fever, rheumatic arthritis, and destructive growths involving structures forming the atlantoid joints, (3) paralysis of the neck muscles in poliomyelitis and diphtheria, and (4) unguarded sudden movements of the head. Some fatal cases have been reported.

The clinical picture of the three types of dislocation is essentially the same—torticollis. One sign is pathognomonic of occipito-atlantoid dislocation: palpation of the transverse process of the atlas slightly below and behind the mastoid. Normally this is about halfway between the mastoid and the angle of the mandible in adults, and slightly posterior to this point in children.

Recognition of an occipito-atlantoid dislocation on the roentgenogram is not easy. Basal views of the skull, showing the atlas and axis, with the central ray directed downward through a point one inch anterior to the middle of a line joining the tips of the mastoid processes, usually give the most information. Right and left lateral views should be taken and an anteroposterior view through the open mouth. Normally if the head is rotated the lateral mass of the atlas will appear over the axis. This may lead to an erroneous diagnosis. In dislocation there is usually also a marked inclination of the atlas against the axis in the lateral views. The normal range of flexion is ten degrees.

These dislocations occur more readily in children than in adults because the occipital condyles are much less developed and the planes of the atlanto-occipital joints are almost horizontal. In adults dislocation is impossible without fracture.

The occurrence of these dislocations in inflammatory diseases may be accounted for by two theories: (1) avulsion of the ligaments from decalcified bones, or (2) spread of the infection *via* the lymphatics to the axis and atlas with the production of edema, with distention of the capsule of the joints.

One case is presented. SYDNEY J. HAWLEY, M.D.

Fractures of the Neck of the Femur. Vernon L. Hart. Surgery **12:** 763–767, November 1942.

The author has recently observed two cases, each of which exhibited two types of femoral neck fractures, an impacted or abduction fracture of one hip and an unimpacted or adduction fracture of the other hip. The incidence and features of the two types of fracture are contrasted in a table which shows that the abduction or impacted type accounts for 15 or 20 per cent of all fractures of the femoral neck, while 80 to 85 per cent are of the adduction or non-impacted type. In the abduction type the pain and muscle spasm are slight and the patient may walk after the injury. There is no fixed deformity and no shortening occurs. The x-ray examination always shows a subcapital fracture line with a coxa valga deformity; never a coxa vara deformity. The fracture line is almost horizontal and forms an angle of not more than 30 degrees with the horizontal line through the anterosuperior iliac spine; the fragments are impacted. No displacement or shearing of fragments is seen in a lateral radiogram and pressure forces between the fragments dominate in both anteroposterior and lateral views. The distal fragment is abducted in relation to the proximal head fragment. Union always occurs, and there is no absorption of bone from the femoral neck. Aseptic necrosis is quite infrequent and the end-result in cases uncomplicated by aseptic necrosis of the femoral head is perfect function. Adduction or non-impacted fractures, on the contrary, produce severe pain and muscle spasm and marked disability. There are always adduction and external rotation with shortening. Films show a subcapital transcervical or basal fracture line with coxa vara deformity. The fracture line forms an angle of 30 to 90 degrees with the horizontal line through the anterosuperior iliac spine. There is no true impaction, although the fragments may overlap slightly and seem to be impacted. Frequent displacement and shearing force are obvious in the lateral roentgenogram. The shearing forces dominate over pressure forces in both anteroposterior and lateral views. Adduction of the distal fragment in relation to the proximal head fragment is present. In treatment accurate reduction and efficient internal fixation are required. A high percentage of these fractures, if properly reduced and immobilized, will unite. Absorption of the femoral neck is frequent, however, in the absence of accurate reduction. Aseptic necrosis is of relatively frequent occurrence.

J. E. WHITELEATHER, M.D.

Laminagraphy of the Sphenoid Bone. Bernard S. Epstein. Am. J. Roentgenol. **48:** 625–631, November 1942.

In routine roentgen examinations of the skull, the greater part of the sphenoid bone is hidden by the superjacent osseous shadows. In order to overcome this difficulty, the author has utilized laminagraphy and illustrates the results obtained by the presentation of five case reports. One was a case of sarcoma involving the base of the skull; 2 were meningiomas; and 2 were cases of metastatic carcinoma. In all of these, the lateral laminagrams gave information concerning the extent of bony destruction and involvement that could not be clearly demonstrated in the routine projections. By means of this procedure it is possible to demonstrate the anterior and inferior walls of the body of the sphenoid as well as the individual alae.

L. W. PAUL, M.D.

Dural Constricting Ring with Cervical Protruded Intervertebral Disk: Report of a Case. W. G. Haynes. New England J. Med. **227:** 825–827, Nov. 26, 1942.

The incidence of the Arnold-Chiari malformation at the foramen magnum associated with syringomyelia or hydromyelia of the upper cervical cord has been noted by many investigators. Some are inclined to the opinion that the constricting band is secondary to the cavity formation in the cord, while others believe the reverse may be the true sequence. The present case report would tend to support the contention that a space-occupying lesion of ong duration may be the

cause of a constricting band of adhesions about the cord. There was no evidence of platybasia or upper cervical malformation and it is emphasized that the case is not one of Arnold-Chiari malformation.

The patient was a 36-year-old male, complaining of pain in the right arm, extending along the ulnar side. There was no history of trauma. Roentgenograms taken elsewhere were said to reveal a dislocation of the 5th cervical vertebra on the 6th. Neurological examination showed a fine nystagmus on looking to the left and increased reflexes on the right side. There was tenderness over the 4th cervical vertebra, but repeated roentgenograms of the cervical spine failed to verify the dislocation mentioned above. Spinal puncture showed evidence of an almost complete block. The area was explored and a large amount of fluid evacuated from beneath the dura. No cyst was found in the cord but a protruding disk was present between the 5th and 6th cervical vertebrae. Attempt to pass a catheter cephalad met with obstruction, beneath the first cervical vertebra, found to be due to a constricting band of dura which compressed the cord at the foramen magnum. No bone malformation was found. Correction of these abnormalities resulted in complete recovery. JOHN B. MCANENY, M.D

Roentgenographic Soft Tissue Study in an Orthopedic Hospital. R. W. Lewis. Am. J. Roentgenol. **48:** 634–642, November 1942.

The value of roentgenographic study of the soft tissues in the extremities and around the joints is emphasized. In most portions of the body, bones and soft tissues can be studied satisfactorily on the same film provided the films are not made unnecessarily dark and that different intensities of illumination are used in studying them. A separate gooseneck lamp equipped with a Mazda 100-watt bulb has been found useful by the author in studying especially dark films, and with this illumination the soft-tissue detail can be brought out very well.

The author describes and illustrates some of the soft-tissue lesions which can be demonstrated. Without soft-tissue study, the differential diagnosis of the various types of arthritis is almost impossible. Faint deposits in or swellings of the various bursae may be demonstrated. Cyst of the lateral meniscus of the knee may be seen as a smooth, soft-tissue swelling along the outer joint margin. Inflammation about tendons, especially those lateral to the lower extremity of the radius, is frequently suggested by a hazy soft-tissue swelling in this region. Inflammatory calcareous deposits are laid down along some tendons, most frequently the supraspinatus. Ganglia at the back of the wrist appear as localized soft-tissue bulges with absence of any evidence of joint disease.

Good visibility of soft-tissue neoplasms is often possible, and their nature can be suspected in some cases from their location, density, and structure. In the knee joint, the more common neoplasms are xanthomas, angiomas, and synoviomas. These can be recognized as masses when there is not too much associated synovitis, but further differential diagnosis is not generally possible. In traumatic cases sprains show subcutaneous swellings in characteristic regions without capsular distention as a rule and without evidence of bone injury. Synovitis is manifested by capsular distention, accompanied in the knee joint by a pyriform mass in the suprapatellar pouch. Subcutaneous varicosities are clearly visible in roentgenograms of proper density. Angiomas are sometimes recognizable as more or less localized collections of tortuous veins, and if phleboliths are present, diagnosis can be readily made.

The article is illustrated with reproductions of roentgenograms and accompanying tracings of many of the conditions discussed. L. W. PAUL, M.D.

THE GENITO-URINARY TRACT

Survey of Deaths and Unfavorable Sequelae Following the Administration of Contrast Media. E. P. Pendergrass, G. W. Chamberlin, E. W. Godfrey, and E. D. Burdick. Am. J. Roentgenol. **48:** 741–762, December 1942.

In response to questionnaires mailed to radiologists and urologists in the United States and Canada the authors received 1,048 replies. These furnished information on a total of 661,800 urographic examinations. An analysis of the questionnaires showed that 26 deaths had occurred in addition to those already reported in the literature. The deaths fall into two general groups: (*a*) immediate death due to hypersensitivity or idiosyncrasy to the drug injected or to colloidal shock; (*b*) delayed death presumably due to preexisting major renal damage. All deaths were in patients who had received diodrast. None of these had been subjected to any of the recently proposed tests for diodrast sensitivity.

Ten deaths occurred shortly after the injection of diodrast. In this group was a 20-months-old child who received 15 c.c. of 35 per cent diodrast. Overdosage may have been a factor here. In another case death was thought to have been due to acute anuria with retention of diodrast and of metabolites, perhaps due to the effect of diodrast on previously diseased kidneys.

There were 16 cases which did not show immediate hypersensitivity and shock. Death was delayed for periods of six hours to twenty-five days. In the patient who died on the twenty-fifth day, vascular nephritis was found at autopsy. The pathologist and the attending physician, as well as the authors, believed that diodrast did not contribute to this death. There appears to be room for doubt, also, in other cases as to the extent to which the diodrast was responsible for the patient's death. In several there was disturbed renal function due to various types of kidney disease. A number of the reports were quite lacking in details.

In the cases previously reported in the literature, numbering 11, there is great difficulty in establishing the cause of death. Most of the patients had severe visceral damage, and particularly renal incompetence or destruction. The relationship may be coincidental, the patient dying as a result of the disease rather than the procedure.

Hypersensitivity, simulating anaphylactic shock, was reported 77 times by radiologists and 55 times by urologists. These figures probably represent an exaggerated incidence. This type of reaction was reported from the drugs diodrast, diodrast compound, iopax, neo-iopax and skiodan. Generalized reactions of the anaphylactic type reported in the literature are urticaria, rhinitis, lacrimation, salivation, syncope and shock. Toxic reactions to the contrast substances occurred chiefly in cases where renal damage was present.

Contrast media are contraindicated in patients with severe liver disorders, nephritis, exudative diathesis (in children), and severe uremia; they should be used with caution in pulmonary tuberculosis, hyperthyroidism and in patients in whom a reduction of blood pressure would be dangerous (quoted from 1941 issue of *New and Non-official Remedies*). Caution is also advised in asthma and other allergic disorders, in patients who have had a nephrectomy and have disease in the remaining kidney, in the presence of severe jaundice, and in those who have had repeated injections of contrast media. The authors suggest that an emergency tray be available during and after the injection of the contrast medium to combat a reaction. This should contain epinephrine, atropine sulphate, caffeine sodio-benzoate, and calcium gluconate.

Contrast media are considered safe for retrograde pyelography, in the absence of extreme sensitivity, since little, if any, of the drug enters the blood stream.

Although fatalities have occurred after intravenous injection of the contrast media, the authors feel that no one would wish to abandon their use, as they have permitted such great advance in diagnosis. It behooves us to be on the alert, therefore, when these agents are used, so that neither they nor we will fall into disrepute. CLARENCE E. WEAVER, M.D.

Roentgen-Ray Dosage During Routine Diagnostic Studies. Magnus I. Smedal. Am. J. Roentgenol. **48:** 807–815, December 1942.

There is a growing tendency to forget that biological reactions may occur after repeated roentgen diagnostic procedures. The author began to measure the amount of radiation received by the skin, with the purpose of determining whether or not there was any danger in exposing pregnant women to repeated pyelographic studies. A Victoreen r meter was used at the actual tube-skin distance, which would vary according to the size of the hypothetical patients. Since the usual target-film distances employed in diagnostic work vary from 25 to 40 inches, when the Potter-Bucky diaphragm is utilized, and since the ordinary line-focus tube covers a 14 × 17-inch film at a tube-film distance of 24 inches, a skin area at least 8 inches square is irradiated and the maximum of back-scattering is therefore obtained.

The exposures used represented those which were known to give satisfactory films of the urinary tract for each of several installations. The maximum intensity recorded for a single exposure was 26 r. The voltage and the distance used were those required for a person measuring 10 inches through the abdomen, and no filter was used. The total for eight exposures (an intravenous pyelographic series) would be 208 r. This figure lies just under the threshold value of 227 r for a large field size and unfiltered radiation. The use of a 1-mm. aluminum filter in this instance cuts down the radiation from 26 r to 8 r. For patients of average size the values are lower. The margin of safety for the skin is tremendously increased by the use of 1-mm. aluminum filter. There is also a considerable filtration effect obtained by increasing the tube-film distance.

Considering the figures in the tables given by the author, it would seem that skin reactions should occasionally occur. That they do not is probably due to the rapid loss of radiation effect in the skin. There is apparently a wide range in the reaction of individuals to radiation which, according to McKee (X-Rays and Radium in the Treatment of Diseases of the Skin, Lea and Febiger, 3d ed., 1938, p. 126), amounts to a 100 per cent variation from the accepted erythema dose. In a few persons with very light complexions, he has seen an erythema result from 75 r of unfiltered radiation. These are probably cases of so-called idiosyncrasy. The amount of radiation received by a patient when no filter is used is three to four times that received when 1 mm. of aluminum is used as a filter. Roentgenographically there is very little difference between the two technics. It is well to remember that many so-called protected tubes have no inherent filtration factor except the glass in the tube. In roentgenoscopy, by simply adding an aluminum filter to equal a total 1 mm. of aluminum, the amount of radiation in roentgens per minute, measured at skin distance, dropped 40 per cent in two separate installations. There is more inherent danger in the shock-proof bedside and portable units which are used so much in fracture work.

The amount of radiation received by the deep pelvic organs during roentgenographic procedures is very small. The depth dose at 10 cm. below the skin surface, for roentgen rays generated at voltages of 100 kv. (peak) or less, is approximately 6.6 per cent of the skin dose as measured in air, when the quality of the radiation has a half-value layer in aluminum of 0.9, and the field size is 250 sq. cm. If we therefore take the maximum skin dosage delivered by the unit mentioned above without filtration, that is 208 r, the depth dose at 10 cm. would be only 14 r. The effect of diagnostic exposures is therefore practically negligible, even if the very high value for unfiltered radiation is used. The minimum abortive dose being 300 r for heavily filtered high-voltage radiation, it seems obvious that there is a very wide margin of safety.

CLARENCE E. WEAVER, M.D.

Hypersensitivity to Diodrast as Determined by Skin Tests. S. A. Robins. Am. J. Roentgenol. **48:** 766–769, December 1942.

Two hundred and forty patients who were to receive diodrast intravenously were examined for hypersensitivity by intradermal injection of the medium. All examinations were done on a fasting stomach, no food or drink having been taken for at least twelve hours prior to the examination. Undiluted diodrast or compound diodrast, 0.05 c.c., was injected in the skin of the forearm. A wheal over 10 mm. in diameter ten to fifteen minutes after injection, with pseudopod and erythema, was considered a strongly positive reaction. In patients reacting positively only 1 c.c. of the dye was injected intravenously and the patient was carefully watched for one minute before the remainder of the dye was given. If any symptoms occurred, 0.25 c.c. of epinephrine was given intramuscularly before the administration of the total dose.

The reactions to intravenous injection fell into four categories: (1) normal; (2) psychogenic; (3) autonomic or neurovascular; (4) allergic. No fatalities occurred. In 186 cases (77.5 per cent) systemic reactions were absent. Of this group, (20.9 per cent) gave a positive skin reaction. A psychogenic reaction—characterized by restlessness, nervousness, faintness, numbness, tingling of the extremities, nausea, and back pain—was observed in 15 cases (6.2 per cent), in none of which was the skin reaction positive. In Group 3, symptoms such as marked flushing of the face, later pallor, cyanosis,

evidence of peripheral vascular failure, sweating, dilation of the pupils, cold extremities, tachycardia, rapid respiration, nausea, and vomiting occurred. These were present in 19 cases (7.9 per cent). Five of these patients (26.4 per cent) showed a positive skin reaction, while 14 were negative (73.6 per cent). In Group 4 there occurred urticaria, mild rhinitis, sneezing, wheezing, difficulty in breathing, conjunctivitis, and edema of the eyelids and face. These symptoms are controlled by the subcutaneous administration of epinephrine. These allergic reactions occurred in 20 cases (8.3 per cent), in 14 of which a positive skin reaction had been obtained. No induced hypersensitivity following repeated injections of diodrast was noted by the author. No noteworthy changes in blood pressure readings were observed.

Although the skin tests do not permit a definite conclusion as to the development of systemic reactions and their severity, it is believed that, at least in some cases, untoward reactions can be foretold. By anticipating systemic reactions, one can be properly prepared to meet a possible emergency.

CLARENCE E. WEAVER, M.D.

An Ocular Test for Sensitivity to Diodrast Prior to Intravenous Urography. V. W. Archer and I. D. Harris. Am. J. Roentgenol. **48:** 763–765, December 1942.

The authors describe an ocular test for sensitivity to diodrast, which in their experience has proved to be both simple and accurate. The following technic is used: (1) both eyes are first examined for comparison; (2) a drop of the dye is then placed directly on the conjunctiva; (3) the patient then closes his eyes, as in sleep, for one and a half minutes; (4) both eyes are examined (daylight preferred) at one and a half and three and a half minutes following the instillation; (5) the reacting eye is directly compared with the control.

Reactions are roughly divided into three types: minimal injection of the conjuctiva, moderate injection of the conjunctival and scleral vessels, and marked injection of the sclerae and conjunctivae. The last type absolutely contraindicates the intravenous injection of the dye. When doubt exists as to whether the reaction is of the second or third type, it is better to repeat the test several hours later or forego examination with diodrast. Patients should be warned not to rub the eye after the injection. Nervous patients should be given a sedative. The presence of alcohol on or in the needle of the syringe should be avoided, as this may produce a false positive reaction when dropped into the eye. There have been no false negative reactions and no sequelae have occurred. The authors feel that this test is superior in accuracy and simplicity to any other recognized test.

CLARENCE E. WEAVER, M.D.

Laminagraphy as an Aid in Urological Diagnosis. S. F. Wilhelm. Urol. & Cutan. Rev. **46:** 706–708, November 1942.

The author has found laminagraphy following perirenal insufflation to be both practical and useful for study of the suprarenal region. Anteroposterior films are taken. Shadows of the normal suprarenal gland are most distinctly outlined at a level of 6 to 10 cm. above the table top. In the presence of tumors the clearest views are obtained at variable levels depending upon the size and location of the mass.

Ten cases of suspected suprarenal disease were studied with both plain films and laminagraphy, following perirenal insufflation. Filtered air (250–400 c.c.) was slowly introduced into the perirenal region by means of a pneumothorax apparatus. In 6 cases air was introduced on both sides.

In 2 instances the adrenal glands were not shown on either the plain film or the laminagram. In all but 2 of the remaining cases the author felt that they were more clearly delineated on the laminagram. In 2 instances an adrenal neoplasm was shown by both methods, but the laminagraphic view was considered superior in sharpness and clarity. Adrenal calcification, renal calculi, and foreign bodies are also demonstrable by this technic. The method is especially useful in the localization of calcific shadows in cases in which cystoscopy and ureteral catheterization cannot be done and those in which excretory urography is not feasible. MAURICE D. SACHS, CAPT., M.C.

Cystic Disease of the Upper Urinary Tract: Pyelitis Cystica and Ureteritis Cystica. A. E. Bothe and D. S. Cristol. Am. J. Roentgenol. **48:** 787–793, December 1942.

The authors review the various opinions as to the etiology and pathology of urinary tract cystic change. They conclude that cyst production most probably results from parent epithelial cell nests and that the cysts originate from central cell degeneration in such nests. No evidence of a secretory process origin was revealed by their study. Both von Limbeck and von Brunn recognized the presence of epithelial cell collections beneath the urinary tract mucous membrane Those epithelial cell groups which were completely separated from the overlying mucous membrane were considered to be cell nests.

Jacoby (Ztschr. f. Urol. **23:** 718–723, 1929) is generally given credit for having made the first clinical diagnosis of ureteritis cystica in 1929. Diagnosis is suggested by a history of chronic urinary tract infection associated with hematuria and is confirmed by ureteropyelography. A characteristic mottling due to non-opaque filling defects in the outline of the ureter is seen in the ureterogram. The pyelogram may demonstrate filling defects of the pelvis or of the calyces. Early polycystic kidney and chronic nephritis must be differentiated, while in the ureter, non-opaque stones, blood clots, multiple papillomata, and bubbles of air are to be ruled out.

Kindall (J. Urol. **29:** 645–659, 1933) suggested treatment by passing a large ureteral catheter to the renal pelvis and leaving it *in situ*. This results in the mechanical rupture of many cysts. Just prior to removal of the catheter a solution of silver nitrate is injected, which serves to destroy the traumatized cysts by its astringent action. Removal of the involved kidney and ureter has been resorted to by others.

In routine microscopic examination of ureters from 54 consecutive autopsies, the authors found evidence of cell buds, nests, or cysts in 38 cases. In routine gross examination of 90 pairs of ureters, they found 4 cases with macroscopic cyst formation. They agree that this pathologic change has its origin in underlying inflammation. To date they have carefully but unsuccessfully searched for specimens which show associated local malignant change.

While the presence of cystic change in the bladder more often than not will be accompanied by cystic change in the ureter, it is possible to find the pathologic change confined to only one of these organs. The lesions are more often confined first to the ureter, second to the ureter and renal pelvis, third to the bladder and ureter, and finally to all three organs.

Two case histories are given. In one patient the intravenous pyelograms showed a moth-eaten contour of both pelves. Similar small defects were evident in several areas of the ureters. Cysts were also found in the bladder on cystoscopic examination. In the second case the diagnosis was indicated by retrograde pyelographic studies. Reproductions of roentgenograms are not included. Photomicrographs illustrate the evolution of cysts from epithelial cell nests.

CLARENCE E. WEAVER, M.D.

Renal Ectopia with Fusion. L. H. Dembo Urol. & Cutan. Rev. **46:** 754–756, December 1942.

The author reports a case of renal ectopia with fusion in a twelve-year-old colored girl. This case is of particular interest in that the patient had been under observation, from birth. Beginning at the age of two, there were recurrent attacks of abdominal pain, and at the age of three years a freely movable mass was felt in the right lower quadrant. Two years later an exploratory laparotomy was done and a horseshoe kidney was found on the right side. Pyelograms made a few weeks later showed the kidney displaced to the right and downward and so rotated that the pelvis pointed toward the flank. Right lower quadrant pain recurred at varying intervals, but was never severe enough to be disabling.

MAURICE D. SACHS, CAPT., M.C.

Vertebral Vein System as a Mechanism for the Spread of Metastases. O. V. Batson. Am. J. Roentgenol. **48:** 715–718, December 1942.

The pattern of invasion of the pelvis and the vertebral column in the spread of primary carcinoma of the prostate or primary carcinoma of the seminal vesicles is characteristic. It does not correspond to the lymphatic drainage of the region, but mirrors the pattern of the extensive plexus of veins in the pelvis itself, and the soft tissues about it, and in the plexus of the veins in and about the vertebral column. This venous plexus is for the most part without valves and the vessels are of considerable caliber. Since the deep dorsal vein of the penis is an integral part of the prostatic vein plexus, the author injected this, in living monkeys, with a roentgen opaque material and observed its subsequent flow up into the inferior vena cava. When, however, a tight binder was placed about the abdomen during the injection, the injected material was blocked in its course along the inferior vena cava and, instead, ascended the vertebral vein plexus, illustrating the flow from the prostatic vein plexus into the vertebral vein plexus, giving a pattern similar to the pattern of the spread of prostatic carcinoma. This vertebral vein plexus with its tributaries and extension forms a large venous lake or reservoir. This is connected with the veins of the thoraco-abdominal cavity at each vertebral level. The flow of blood in such a low-pressure system need never be constant in its direction. Once carcinomatous material has gained access into the lumen of these vessels, it is easy to understand how the material can be transmitted to produce metastases in the vertebral column, in the girdles, even in the skull, without the lungs themselves being involved. The vertebral vein plexus, protected as it is in the bodies of the vertebrae, in the deep muscles of the back, and in the spinal canal, does not come under the pressure changes of the body cavity as do the vena cava and the azygos veins. A by-pass can take place.

It is suggested that this vertebral vein system, considered as a system rather than as a plexus of the vertebral column in the strict sense, provides a series of passage-ways by which solitary malignant emboli can be deposited in remote parts. The many changes in pressure and direction of flow in this system make this possible. CLARENCE E. WEAVER, M.D.

Carcinoma of the Prostate; Immediate Response to Bilateral Orchiectomy; Clinical and X-Ray Evidence. E. P. Alyea and A. F. Henderson. J. A. M. A. **120:** 1099–1102, Dec. 5, 1942.

This is a report of 40 cases of carcinoma of the prostate treated by castration. The immediate result in all these patients was almost miraculous. Their general well-being and energy at once improved, their appetites picked up, and they gained weight. One of the striking features of improvement was the rapid relief of metastatic pain, usually within twenty-four to forty-eight hours after castration. One patient had a relapse and extension of the tumor after eight months of comfort. Fourteen patients showed no evidence of metastasis at the time of castration. Seven of these had subsequent x-ray examination and at the time of the report none showed metastases. The first case was then of one year's duration.

Acid phosphatase is found in large amounts in the adult prostatic epithelium and carcinoma of the prostate, which arises from this tissue. When metastasis takes place, the tumor cells are expressed into the blood stream and lymphatics and cause a rise in the serum acid phosphatase. The alkaline phosphatase is also increased in these cases. This is dependent on a bone defense reaction to the tumor. In this series 4 King and Armstrong units were taken to represent the normal. Serum acid phosphatase in excess of 10 units is almost surely indicative of carcinoma of the prostate. The amount may, however, be perfectly normal with or without metastases.

Androgen activates the prostatic or tumor cells. Castration and the removal of the androgen causes a drop in the index of activation, acid phosphatase, and clinical signs of regression of the tumor are seen. Neutralization of the androgen with estrogen causes the same response. Clinical evidence of regression of the tumor is further indicated by relief of obstruction. Four patients had no operation for removal of the obstruction and are now voiding satisfactorily.

Rectal examination in every one of the 30 patients who returned for examination showed softening and considerable reduction in size of the gland. The case which came to autopsy showed a prostate and seminal vesicles of normal size. A comparison of the microscopic pathologic section of the prostatic tissue before castration with that obtained at autopsy showed decided change, the latter section showing pronounced fibrosis, replacing glandular tissues. Further direct evidence of improvement is the clearing of the urinary infection which most of these patients show before and after transurethral resection.

Most metastases from carcinoma of the prostate are osteoblastic in character. The new bone laid down is soft and appears in islands scattered here and there. Following castration there is a distinct smoothing and sclerosing of bone detail, approaching the normal. The reaction is similar to that seen in post-irradiation healing. This occurred in all but 3 of the authors' cases showing bone metastases. Four patients had pulmonary metastases; in 2 cases these were of the small multiple miliary type. Careful differential diagnosis between tumor, sarcoid, and moniliasis was necessary. Roentgenograms in these cases two and a half months after castration, and in one case five months later, showed that the metastatic nodules had disappeared. This is the first time this phenomenon has been demonstrated.

Diethylstilbestrol has been tried in carcinoma of the prostate. This resulted in regression of the primary growth and relief of pain. But the results were not as striking as following castration.

The authors emphasize that this is a report of the *immediate* results of bilateral orchiectomy, results which have been remarkably favorable. They do not prophesy what will happen to these patients after the first postoperative year.

CLARENCE E. WEAVER, M.D.

THE SPINAL CORD

Calcification and Ossification of Spinal Tumors. E. D. Gray. Brit. J. Radiol. **15:** 365–369, December 1942.

Abnormal calcification is frequently looked for in the skull as an indication of an intracranial tumor. The small number of references in the literature indicates how little attention is paid to calcification in the spinal canal in spinal tumors. Three cases of this condition are reported, 2 meningiomas and 1 hemangioblastoma.

It is estimated that not more than 10 per cent of spinal tumors will cast a recognizable shadow.

SYDNEY J. HAWLEY, M.D.

Effect of Iodized Poppyseed Oil on the Spinal Cord and Meninges: Experimental Study. R. L. Craig. Arch. Neurol. & Psychiat. **48:** 799–810, November 1942.

Since the introduction of iodized poppyseed oil for myelography it has been known that immediately after injection there is an acute cellular reaction, chiefly lymphocytic, usually associated with mild symptoms, such as slight rise in temperature, headache, pain and stiffness in the back, and aggravation of root pains. These reach a peak within twelve to twenty-four hours and subside within four to seven days. There is evidence that these acute meningeal reactions are due to end-products resulting from splitting of the iodized oil. Serious meningeal reactions are rare.

Several studies done in the past, in which the amounts of oil used were relatively large for the animals employed, showed that the presence of iodized oil in the spinal subarachnoid space is capable of producing chronic leptomeningitis. This leads to encystment of oil globules and vascular changes consisting of congestion, hemorrhages, thromboses, and capillary proliferation. Necrosis within the gray matter may also occur. One group of observers demonstrated that the severity of the reaction is directly proportional to the quantity of oil injected, small amounts being tolerated without any significant pathological effects. In most of the studies, the amounts were proportionally much greater than those used in man.

The present study was undertaken to determine the effect of amounts of oil comparable to those used clinically. As a basis of comparison the amount of iodized oil per unit of body weight was used, though the author points out that this is not the best means of comparing, since the relative volumes of the spinal canal and contents do not bear the same relationship to body weight in man and dogs.

Small amounts of iodized oil were injected intrathecally in dogs, and the animals were sacrificed after an interval of from 14 to 314 days. The findings consisted only of slight inflammatory changes involving the leptomeninges and the walls of the blood vessels coursing through the subarachnoid space. No lesions were seen within the cord. The changes were most pronounced in the animal sacrificed earliest (14 days) after injection of the iodized oil. The limited character of the changes in this study as compared with others is believed to be due to the use of small quantities of oil, comparable to those in clinical use.

DEPARTMENT OF ROENTGENOLOGY,
UNIVERSITY OF MICHIGAN (B. D. J.)

FOREIGN BODIES

Foreign Body Localization by X-Ray. E. R. Miller. California & West. Med. **57:** 349–351, December 1942.

The author describes a simplified method for deep foreign body localization which any civilian radiologist can use with his present x-ray unit. It is based on the parallax principle.

A standard fluoroscopic table is used, with a 7-inch crossway shift of tube and screen and a 24-inch tube screen distance. Six inches of the crossway shift are used. Cleared film is placed over the screen and a cross is placed over the center of the image as seen on the fluoroscopic screen. One cross is placed 3 inches to the left of the center cross and another 3 inches to the right of the center cross. Under fluoroscopic control the body is located and a mark is placed on the skin over the image. The image of the foreign body is made to coincide with the right cross on the screen. The tube carriage rod at the side of the table is then marked with a pencil. The foreign body image is then made to coincide with the left cross on the screen and again the tube carriage rod at the side of the table is marked. The difference between the distances between the crosses on the screen (6 inches) and on the tube carriage is one-fourth the distance from the screen to the foreign body. Subtracting the screen skin distance gives the actual depth of the foreign body.

A simplified method of reading the depth of the foreign body on the fluoroscopic screen is also possible, but the scale is so small (1/8 inch representing 1 inch) that large errors are possible. After marking the crosses, as above, a scale in one-eighth inches is marked off on the cleared film between the crosses. The fluoroscopic screen is then manipulated so that the foreign body coincides with the center cross. A skin mark is placed over the foreign body. The tube is then moved 3 inches to the right. The foreign body image is now seen on the 1/8-inch scale. The screen skin distance is subtracted and the depth of the foreign body is determined. MAURICE D. SACHS, CAPT., M.C.

RADIOTHERAPY

TECHNIC AND DOSAGE

Total Body Irradiation, with Review of Cases. F. G. Medinger and L. F. Craver. Am. J. Roentgenol. **48:** 651–671, November 1942.

This report presents a critical analysis of 270 cases treated at the Memorial Hospital (New York) over a ten-year period, from 1931 to 1940, using the method of total body irradiation first described by Heublein (Radiology **18:** 1051–1062, 1932). The results are presented in graphic and tabular form. The diseases showing the greatest benefit from this therapy are chronic lymphatic and myelogenous leukemia, Hodgkin's disease, lymphosarcoma, and polycythemia vera. Less striking improvement was noted in mycosis fungoides and multiple myeloma. No appreciable improvement was obtained in generalized metastatic carcinoma or sarcoma. The results in this series of cases indicated that total body irradiation produced the greatest benefit when combined with local high-voltage roentgen therapy.

Numerous theories have been advanced to explain the beneficial effects of general body irradiation. All agree that this therapy exerts chiefly a constitutional effect, so that the resistance of the patient to his disease is increased, but the exact mechanism remains obscure.

The treatment unit utilizes a tube distance of 3 meters, using 185 kv., 1 ma., 5.5 mm. copper equivalent filtration. The output has varied from 1.5 r per hour to 0.37 r per hour. The unit operates twenty or twenty-one hours for each twenty-four-hour period, so that a dose of 100 r requires about six days of treatment. It is emphasized that the treatment of each case must be carefully evaluated beforehand and the dosage individualized. A dose of 300 r given in one continuous course in ten days appears to be the upper limit of safe dosage for a patient in good condition, but in many patients transient toxic reactions appear which preclude dosages higher than 50 or 100 r.

Marked vomiting, weakness, apathy, fever, purpura or hemorrhage, and the development of leukopenia are the danger signals calling for discontinuance of total irradiation. Leukopenia resulting from depression of the bone marrow is the most important complication, and, wherever possible, should be avoided. In no case with a white count of greater than 5,000 before treatment did total body irradiation result in a permanent or fatal neutropenia. In general, wherever leukopenia exists as a result of recent localized irradiation with large doses, its increase may be expected from further roentgen therapy, but if leukopenia exists because of active disease, improvement in the blood picture following therapy may be anticipated.

L. W. PAUL, M.D.

Tolerance Dosage in Radiotherapy with 200 Kv. X-Rays. F. Ellis. Brit. J. Radiol. **15:** 348–350, December 1942.

The question of the best dose in x-ray therapy is an unsettled one, but not insuperable. The theories and suggestions presented herewith represent the opinions formed after treating about 9,000 patients since 1931.

The action of radiation must be physico-chemical, probably an ionizing process during which the complex molecules of protoplasm are broken up. During recovery these broken molecules recombine. Many will not form the same complex molecule as was present originally. If an injured molecule is an important one and recombination does not reproduce it, the cell may die quickly. If, however, the molecule is not so important, the metabolism of the cell may be altered, so that it dies only after a latent period. This may account for the first erythema and the latent period seen after irradiation, and also for some of the phenomena of recovery.

Injury to the nucleus, which destroys the cell more quickly, is apparently due to the fact that more vital molecules are found in the nucleus. A comparison of the nuclear volume of various types of normal and malignant tissues might explain differences in sensitivity.

There is little known difference in the metabolism of normal and malignant cells. The only real difference is that the malignant cells grow without regard to needs of the body and at the expense of the surrounding tissues and, being antagonistic to the body autonomy, are continually exposed to the resistant forces of the organism.

It would seem that the best dose is that which would allow the recovery of the normal cells, but not the malignant cells. Too small a dose will permit recovery of the malignant cells. Too large a dose will hamper the resistance mechanism. This best dose should be that which will allow connective tissue about the tumor to recover. In many instances this is the same as the skin tolerance dose, but not always.

The author presents a table, based on clinical experience, setting forth the maximum doses, measured with back-scatter, at 200 kv., 1.0 mm. Cu plus 1.0 mm. Al filter. Some of these are as follows: For a 6 × 4-cm. field, one dose 2,000 r; treatment period covering one week 3,000 r; four weeks 5,500 r; six weeks 6,000 r. For a field 10 × 15 cm. one dose 1,250 r; one week 1,900 r; four weeks 3,650 r; six weeks 4,000 r. For a 20 × 15-cm. field, one dose 1,100 r; one week 1,700 r; four weeks 3,200 r; six weeks 3,500 r. For a Thoraeus filter, 10 per cent should be added. If three fields are used, subtract 5 per cent at the tumor; five or more fields, subtract 15 per cent at the tumor.

For chronic inflammatory diseases, the single dose is 400 r; two doses in three days, 600 r; three doses in one week; 750 r. For acute inflammatory diseases, the single dose is 100 r; two doses in three days 150 r, three doses in one week 200 r.

A castration dose, over forty, one dose 200 r; three doses in one week 400 r. SYDNEY J. HAWLEY, M.D.

MALIGNANT NEOPLASMS

Roentgen Therapy of Primary Cancer of the Nasopharynx. Maurice Lenz. Am. J. Roentgenol. **48:** 816–832, December 1942.

The clinical material for this study consisted of 63 patients treated with roentgen irradiation for cancer of the nasopharynx between 1926 and 1938. There were 45 males and 18 females. Ages varied between eleven and seventy-seven years. The primary site of the tumor is believed to be most commonly in the region of the pharyngeal tonsil, with the ridge of the

eustachian orifice and Rosenmüller's fossa next in frequency.

So-called respiratory symptoms were the original complaint in 19 of the 63 patients in this series. Most of the lesions in this group probably originated in the region of the pharyngeal tonsil: 14 of the 19 were classified either as lympho-epitheliomas or lympho-sarcomas, both of which arise from tissue rich in lymphoid cells. In 15 of the 63 patients the initial symptoms were classified as auricular and it is assumed that their tumors arose near the eustachian orifice. In 29 cases, or 46 per cent of the series of 63 cases, the primary site was not recognized early: in 22 enlarged cervical lymph nodes dominated the early clinical picture and in 7 attention was first attracted by symptoms referable to cranial nerve involvement.

About half of the patients in this series in whom the base of the skull was investigated roentgenographically showed invasion of the bones. In order of frequency these were the sphenoid body, the greater wings, the petrous, and occipital bones. Just how bone invasion occurs is not agreed upon. It is interesting to note that involvement of the skull occurred in 10 of 15 patients whose primary lesions probably arose near the eustachian orifice and in only 4 of 19 patients with a probable origin in the neighborhood of the pharyngeal tonsil. Cranial nerve involvement was more frequent when the tumors arose near the eustachian orifice. By extension and spread of the growth within the cavernous sinus the superior maxillary and ophthalmic division of the fifth and the abducens nerve would be affected first, while the fourth and third cranial nerves, because of their higher location, would not be reached unless the tumor had grown to a larger size. In addition to involvement of cranial nerves by direct extension, they may probably be compressed by metastatic enlargement of the nearby lymph nodes. Cervical adenitis often dominates the early clinical picture of cancer of the nasopharynx, while the primary lesion remains unrecognized. In the present series this occurred in 35 per cent of the cases. Distant metastases were present in 20 of the 63 cases.

The more common primary malignant tumors of the nasopharynx are the epitheliomas of varying degree of differentiation, lympho-epitheliomas, lymphosarcomas, and cylindromas. In the author's series there were 3 cylindromas (the classical carcinoma of mucous and salivary glands). There were 27 cases of epithelioma, of which 3 were well differentiated, 11 were slightly differentiated, and 13 were undifferentiated. Lympho-epithelioma was encountered in 20 cases, lymphosarcoma in 12 cases, and plasmocytoma in 1 case. Lympho-epitheliomas and lymphosarcomas which probably arose from the region of the pharyngeal tonsil accounted for nearly two-thirds of the cases with initial respiratory symptoms. The tumors originating in the neighborhood of the eustachian tube, *i.e.*, giving auricular symptoms, were chiefly the slightly differentiated epitheliomas, lympho-epitheliomas, and undifferentiated epitheliomas. Bone involvement occurred more often in the more differentiated cancers. Of 45 deaths, nearly half were due to distant metastases. Local persistence of cancer and extension to the skull or brain accounted for most of the other deaths.

In the roentgen treatment two lateral fields averaging 8 × 10 cm. and two 4 × 5 cm. paranasal-anterior antral fields were used. Factors employed were 200 kv. (peak), 2-mm. Cu filter, half-value layer 1.8 mm. Cu, target-skin distance 50 cm. Between 150 and 200 r/o daily were given to each of two of the four fields. A total dose up to 3,000–3,500 r, or occasionally to 4,000 r, to each field was given in a period of about six to seven weeks of daily treatments. In addition to external roentgen therapy, intrapharyngeal treatment with roentgen rays or radium was used in a few instances.

Fifty-four cases were treated solely by external roentgen therapy. Survival of patients treated in this manner appears to be as good as that in series reported by others in which a combination of roentgen therapy and intrapharyngeal radium therapy was used. Though the finding of clinically metastatic lymph nodes aggravates the prognosis, it should not preclude an attempt at a cure by vigorous irradiation of the primary tumor and cervical metastases, provided this is warranted by the general condition of the patient, and distant metastases are absent. In treatment of the cervical nodes, usually about 2,000 to 4,000 r, depending on the size of the irradiated area, is administered per field.

Survival of patients varied with the location and extent of the cancer within the nasopharynx. The prognosis for patients whose primary tumor site was assumed to be near the eustachian orifice was worse than in those whose lesion probably originated near the vault in the region of the pharyngeal tonsil. Patients showing bone involvement did not do so well as those without this complication. Involvement of the cranial nerves, while of serious prognostic significance, did not necessarily indicate that treatment would fail. The presence of clinically metastatic lymph nodes on admission signified a wide extent of the disease and lowered the survival rate. Lymphosarcomas and lympho-epitheliomas are radiosensitive tumors and would be expected to do better than differentiated epitheliomas and cylindromas.

Thirteen of 44 patients treated more than five years ago are now clinically free from cancer. Six tumors in this group are classified as lympho-epithelioma, 5 as lymphosarcoma, 1 as an undifferentiated, and 1 as a slightly differentiated epithelioma.

CLARENCE E. WEAVER, M.D.

Radiotherapy of Cancer of the Antrum. E. Valencia and L. M. Rosenthal. Am. J. Roentgenol. **48:** 672–676, November 1942.

Four cases of cancer of the antrum are reported in which the "concentration method" of roentgen therapy was employed. This method consists in the giving of large daily doses of roentgen rays over short treatment periods—from nine to twelve days. The total dose is sufficient to produce the characteristic *epithelite* in the mucous membrane and *epidermite* of the skin. In selected cases the daily dose is increased as the size of the portal is diminished. The intensity has varied from 3 r per minute to 10 r per minute. In one of the four cases, the clinical and microscopic features indicated the presence of an epidermoid carcinoma of radioresistant type. In spite of this, the lesion responded to the treatment and there was no evidence of disease at the end of three years and four months. In two other cases the lesions were obviously radiosensitive, so that the good results obtained cannot be attributed entirely to the new technic. In the fourth

case the treatment was a failure due to the extent of the disease and the radioresistance of the lesion.

These cases are presented to stimulate interest in this new method, which is believed to offer important advantages in the control of the more radioresistant forms of cancer of the mouth, pharynx, larynx, and accessory nasal sinuses. L. W. PAUL, M.D.

Spread and Metastasis in Carcinoma of the Cervix Uteri. B. Pearson and Manuel Garcia. New Orleans M. & S. J. **95:** 215–219, November 1942.

Seventy-four cases of carcinoma of the cervix which came to autopsy at Charity Hospital of Louisiana in New Orleans (Series A) from January 1930 to January 1942, plus 57 cases from the University of Minnesota (Series B), are reviewed.

In Series A, areas of infiltration were described in 57 cases. The involvement was as follows: bilateral parametrial spread, 60.3 per cent; unilateral parametrial spread, 10.3 per cent; vaginal spread, 32.7 per cent; rectovaginal tissues, 17.3 per cent; vesicovaginal tissues, 8.6 per cent. The incidence of pelvic node involvement was 47.3 per cent as compared to 59 per cent in Series B. From this survey, it is evident that spread occurs predominantly in the lateral direction. The spread in other directions has largely been ignored in the anatomic study of the disease.

The authors next consider the consequences of local spread. In Series A, 65 per cent had *hydronephrosis*, with bilateral ureteral constriction in 54 per cent and unilateral constriction in 10.8 per cent. In Series B, 75 per cent had hydronephrosis, with bilateral constriction in 52 per cent, and unilateral constriction in 22 per cent. The combined incidence of hydronephrosis was 69.5 per cent in the two series (131 cases).

In Series A, *infiltration of the bladder* occurred in 32.4 per cent and vesicovaginal fistula in 10.8 per cent. In Series B, bladder infiltration occurred in 15.8 per cent, vesicovaginal fistula in 7 per cent.

Intestinal obstruction was present in 12.2 per cent of Series A cases and in 12.3 per cent of Series B. This complication has been greatly neglected, probably because of its unimpressive clinical manifestations. The tumor spreads along the uretero-sacral ligaments and constricts the rectum, with ensuing low-grade intestinal obstruction. Intestinal obstruction was the immediate cause of death in 6.7 per cent of cases in Series A, and 7.4 per cent in Series B.

Spread may also occur to the pelvic bones. One such case was found in Series A, 2 cases in Series B. The infrequent occurrence of this complication is generally due to the adequate radiation delivered over the entire pelvis.

Distant metastases were present in 25.7 per cent of cases in Series A and in 25 per cent of cases in Series B. The liver, lung, pleura, and bone were involved in this order of frequency. There were 4 examples of bone metastasis in Series A and 3 in Series B.

The author concludes by stating that current plans of treatment are inadequate in controlling sagittal pelvic spread. STEPHEN N. TAGER, M.D.

Carcinoma of the Fallopian Tube. T. S. Kimball, H. E. Sanford, and A. F. Brown. California & West. Med. **57:** 351–353, December 1942.

Carcinoma of the fallopian tube is largely overshadowed by the much more frequent inflammatory tubal processes. Approximately 375 cases have been reported in the literature. The incidence has been placed at 0.5 per cent of all gynecological operations, and again as 1 in 1,000 salpingectomies. Half the patients are between 40 and 50 years of age. The tumors are of the papillary type and arise in the lateral half of the tube, sealing the fimbriated end, leaving the uterine ostium open. As a result patients often complain of a profuse watery and blood-stained vaginal discharge. This is due to the escape of fluid of inflammatory or degenerative origin from the distended tube into the uterine cavity.

Due to the late recognition of the tumors, the abundant collateral lymphatic system, the tendency to bilateral involvement, and resultant conservative surgery, the prognosis is poor. Five-year cures are obtained in less than 4 per cent.

The authors report three cases. Two of the patients died less than two years after the discovery of the tumor, with diffuse carcinomatosis. The third case is a recent one.

Radiation therapy was not given in any of the three cases, although it was advised in one case and refused. The authors state that little is known of the relative value of x-ray therapy in carcinoma of the fallopian tubes. MAURICE D. SACHS, CAPT., M.C.

Radium Treatment of Cancer of the Vagina. M. Lederman and W. V. Mayneord. Brit. J. Radiol. **15:** 307–312, November 1942.

The surgical treatment of cancer of the vagina, whether primary or secondary, is necessarily radical and is attended by a high mortality. Irradiation has given some encouraging results, but there is much to be desired. This is largely due to the fact that the disease is so rare that an adequate technic has not been developed and lymph node metastasis occurs early; the close proximity of the rectum and bladder, which are easily damaged by radiation; the usually advanced stage of the disease when treatment is started; the technical difficulty of applying radium accurately, especially in the lower vagina.

In the past eleven years, 7 cases have been treated, all advanced. Two patients have survived for three years and one for over five years. The cases were treated with intracavitary radium and external irradiation with x-ray or teleradium.

The intracavitary radium is applied by a special applicator, made for each case individually. The method of making the applicator and the method of locating the radium and the dosage are given in detail but cannot be adequately abstracted.

This method is indicated in lesions of the lower two-thirds of the vagina, with or without vestibular involvement, and in lesions accompanied by bladder, urethral and rectal involvement. In cases with involvement of the rectum and urethra, supplementary radium is inserted in these passages. In some instances with bladder involvement, needles are implanted into the base of the bladder through a suprapubic incision.

SYDNEY J. HAWLEY, M.D.

Five Year Control of Bladder Cancers by Radon Implants. B. S. Barringer. J. A. M. A. **120:** 909–911, Nov. 21, 1942.

Bladder carcinomas are particularly well adapted for attack by radon implants. In a fourth of all cases

cystoscopy offers a means of both seeing and implanting the entire tumor. Three-fourths of the cancers require suprapubic cystotomy. Most papillary cancers of the bladder are situated in the base of the bladder contiguous to ureters and urethra, rendering surgical removal difficult, hazardous, and in many cases impossible. In the female there is less depth of tissue in this area than in the male, and radon implants have of necessity to be more superficial. Infiltrating cancers often do not show the early hematuria of papillary cancers; they readily grow through the bladder wall and metastasize early. Because they do metastasize early it is difficult to see that total cystectomy can offer any more than radon implantation.

Of 257 bladder cancers seen by the author up to and including the year 1937, 112 were papillary and 145 infiltrating cancers; 15 cases are excluded from the statistics because some of them had metastasized, in some the bladder was merely felt through the suprapubic opening, and in some radon was implanted because of hematuria. Other cases, which were proved cured but in which death occurred from some intercurrent disease or which were lost track of before the five-year period are also excluded from the statistics. This leaves 50 (56.1 per cent) of the 89 patients with papillary cancer who were well for five years. Of 121 patients with infiltrating cancer, 35, or 28.9 per cent, were well for five years. Of 210 patients with combined papillary and infiltrating cancer, 85, or 40.4 per cent, were well for five years.

In the suprapubic operation, use is made of sulfathiazole crystals following radon implantation, both in the bladder and in the suprapubic wound. This is done because many of these tumors are badly infected. Radon seeds of a strength between 1.0 and 1.5 millicuries are planted, one seed to a square centimeter. If the tumor is directly over one ureteral orifice and there are both hydroureter and hydronephrosis, an attempt is made to place a large ureteral catheter (8 F) in the ureter at the time of the cystotomy operation. This is left in place several days. By this means it has been possible to save some kidneys and prevent an infection of a hydronephrotic kidney.

Fifty-eight per cent of the tumors were more then 10 sq. cm. in size; 80 per cent were on the bladder base, involving or near the internal urethra or one or both ureters. Suprapubic implantation was done 183 times and cystoscopic implantation 89 times. As these figures indicate, a combination of suprapubic and cystoscopic implantation was done in some of the cases.

Stone formation on the dead tumor base is probably the most important complication. In 2 cases vesicovaginal fistula followed the radon seed implantation.

Tumors of the bladder vault do best following surgical excision. These are apt to be highly malignant and metastasize to the lymphatics around the urachus. Total cystectomy is indicated for the widely disseminated papilloma or papillary carcinoma. All other tumors, both papillary and infiltrating, are better dealt with by radon implantation.

CLARENCE E. WEAVER, M.D.

NON-MALIGNANT DISEASE

North American Cutaneous Blastomycosis Treated with Superficial Roentgen Therapy: Report of Four Cases. J. E. Hemphill and R. O. Noojin. Am. J. Roentgenol. **48:** 643–650, November 1942.

North American blastomycosis is a chronic inflammatory, infectious disease produced by *Blastomyces dermatitidis* and is of two distinct types: (1) systemic and (2) cutaneous or localized. The authors report 4 cases of the cutaneous type in which treatment included superficial roentgen therapy with very good results. Treatment consisted of small doses of roentgen rays, generated at 100 kv., constant potential, inherent oil filtration equivalent to 3 mm. Al, with a half-value layer of 3.2 mm. Al, measured in air, without back-scatter. A 15-cm. target-skin distance was used. Single doses of 75–100 r were given at weekly or ten-day intervals for a total dosage sufficient to produce smoothing off of the borders and removal of the signs of activity of the infection. The total dosage required varied with each individual, but 1,500 r or less seems to be adequate. The first obvious effect of irradiation is drying of the central portion of the lesion. Next the foul odor disappears, the erythematous granulation blanches, and the peripheral border begins to become smooth. When there is evidence of healing at the center, this dry and flat scar is carefully shielded with lead foil on subsequent treatment, so that only the borders receive additional radiation. In the authors' cases the central portion of the lesion required very little of the total roentgens given, and early healing occurred in this region. In addition to roentgen therapy the usual medical measures should be carried out, including the administration of iodides. L. W. PAUL, M.D.

X-Ray Therapy in the Treatment of Chronic Pyelonephritis. J. H. Smith. Texas J. Med. **38:** 448–450, November 1942.

The author reports 7 cases in detail in which deep x-ray therapy was administered for chronic pyelonephritis. Prior to irradiation, an instillation of 1 per cent mercurochrome into the kidney pelvis was done. This is allowed to remain there for 5 to 10 minutes before treatment. Just what part mercurochrome plays in the outcome is unknown.

The radiological factors used are: 200 kv.; filter 0.75 mm. Cu and 2 mm. Al; port of entry 10 × 15 cm., posteriorly; 240 r.

Final reports are available in 5 of the 7 cases, with the usual supportive clinical and laboratory data. These 5 patients have remained free of symptoms for many months.

The author believes that, if others follow this procedure, further corroborative statistical material will be forthcoming. This method is indicated for those cases of chronic pyelonephritis where usual methods of treatment give no response.

STEPHEN N. TAGER, M.D.